MANUAL FOR
EXAMINATION OF PATIENTS

MANUAL FOR
Examination of Patients

SCHOOL OF MEDICINE
and NORTH CAROLINA MEMORIAL
HOSPITAL THE UNIVERSITY of
NORTH CAROLINA, *Chapel Hill, N C*

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Preface

This Manual has been prepared and edited by an interde partmental committee of the faculty for the use of students house officers and staff of the University of North Carolina School of Medicine and the North Carolina Memorial Hospi tal It reflects a general philosophy of patient care and describes the most important aspects of interviewing and physical ex amination and the principal laboratory procedures utilized

The first mimeographed version to which members of the faculty contributed was compiled by 2 of us (DRH and KLW) in 1954 It attempted to satisfy 2 unmet needs (1) the singu lar paucity of material in the textbooks of physical diagnosis on interviewing and history taking probably the most impor tant components of the diagnostic process and (2) the need to *integrate certain important parameters of advancing knowledge* in psychiatry preventive medicine and the behavioral sciences into the broad stream of contemporary medicine Both the over all approach and the particular concepts in Appendices A 1 5 have been strongly influenced by the work of Dr George Engel of the University of Rochester

Experience with the first version of the Manual disclosed the need to broaden its scope so that it would be applicable to all clinical services in addition to medicine and psychiatry It was also considered desirable to include outlines for examina tion in more specialized areas as well as information about the use of clinical laboratories and finally there was an obvious need to publish the Manual in a pocket sized format The second version, published privately by the School of Medicine in 1957 was prepared by an interdepartmental committee but particularly valuable contributions were made by the late Dr Deborah Leary in editing Part II Laboratory Examinations and Procedures and by Dr Nelson K Ordway now of Yale University in Part I Section 3 Special Features of the Eval uation of Children and Appendix D 2 Developmental Ap

praisal of Infants and Young Children as well as in extensive editorial assistance Dr Hughes Bryan and Miss Frances MacKinnon of the School of Public Health University of North Carolina prepared Appendix D 1 Nutritional History Taking and Dr R S Burge of Des Moines Ia gave permission to use his chart Clinical Analysis of Transfusion Reactions Dr Price Heusner Dr Richard Peters Dr Janet Fischer Dr Harvey Smith Dr William Cromartie Dr J G Palmer Dr George Penick Dr Thomas Farmer Dr Robert Brashear Dr John Sessions Dr Oscar Sapp, Dr Ernest Craige Dr Norman Allen as well as many other members of the faculty made important contributions

The second version of the Manual was used throughout the Medical School and the North Carolina Memorial Hospital for 3 years and attracted interest in other schools The need for further revision and the offer of the Year Book Publishers to publish the Manual have resulted in the present edition from which local references to practices at the University of North Carolina have been deleted

It is hoped that students house officers and faculty using the Manual will give the editorial committee the benefit of their comments on both form and content so that future editions may be improved

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PART I

History-Taking and Examination

1 Instructions for Medical Records

An important function of a hospital is to maintain on all patients records that are adequate accurate and easily utilized The case history is a compendium of all the data on a patient obtained by students nurses house officers consultants and technicians It is not only the prime document which records the facts and opinions relating to diagnosis and treatment of the patient s illness it is also a legal document and the source of data used for research of many types Discretion should be used in recording information which may be embarrassing to the patient unless its omission will jeopardize adequate patient care The following entries are customarily made

ADMISSION NOTE

At least a 1 page statement should be made on the patient s chart shortly after admission This note includes

1 a brief summary of the presenting problem,
2 the salient historical features
3 the important physical findings
4 the initial impression and
5 the immediate plan of management

COMPLETE HISTORY AND PHYSICAL EXAMINATION

It is expected that patients will be seen promptly after admission and that the initial interviews and physical examinations will be completed on the day of admission The records should be completed and included in the chart by the morning after admission to the hospital or in the case of an outpatient or a critically ill hospital patient the day the patient is seen The outline which follows indicates the form these records

hould take The appropriate special section should be consulted if the patient is a child presents an emergency appears psychotic or is comatose

PROGRESS NOTES

Appropriate notes should be made describing progress in diagnosis any change in the course of the illness or its management and understanding of the patient For critically ill patients notes may be required from hour to hour

OPERATIVE NOTES

Brief notes describing any procedure or minor operation performed on the ward should be made promptly A short description of any surgical procedure should be recorded before the patient leaves the op rating room This should include the nature of the procedure pertinent findings the names of the operators the anesthesia used parenteral fluids given and condition of the patient on completion of the procedure A complete operative note should be dictated promptly by the surgeon in charge

DISCHARGE SUMMARY

This is the responsibility of designated house officers on the various services It should be dictated promptly in ord r that the referring physician may have the benefit of the service s recommendations for the patient s future care The summary should mention briefly the salient points of the history physical examination diagnostic procedures consultations medications operations or other therapeutic procedures course in the hospital final diagnoses discharge treatment and recommendations and arrangements for follow up visits Copies of the discharge summary are sent to the referring physician the attending staff physician and interested consultants Discharge summaries provide the house officer with a useful cumulative record of his clinical experience

2 Basic Outline of History and Physical Examination

This outline should serve as a guide for the consistent and systematic recording of initial data pertaining to the patient While the acquisition of historical and physical data should never follow a rigid pattern their recording and presentation should be reasonably complete and conform to a conventional orderly arrangement Emphasis in the evaluation and its recording will vary with the patient his problem and the clinical service as well as with the physician and his proficiency Additional information will often be required in the area primarily affected and the detailed sections on history taking and physical examination as well as the other appendices should be consulted for assistance

Abbreviations other than those found in standard texts should not be used

Organize the patient s history before writing it A better conception of the history will be gained and time and writing will be saved

HISTORY

Introductory Information

Record the patient s name age sex ethnic extraction marital status occupation place of residence and referring physician Identify the time and place of examination and record the name and rank or status of the examiner Is this the patient s first visit to this hospital? If he has had previous admissions or clinic visits what is the number of the present one? The source of the information should be stated and an appropriate statement made as to its presumed reliability

1 Chief Complaint

A brief statement in his own words if possible of what concerns the patient most and how long he has been ill

2 Present Illness

When why and how did the patient become ill? This should be a detailed but concise chronological account of all historical information directly relevant to the onset and course of the illness The patient s concept of his illness and what he hopes to gain from his visit should be recorded

3 Family History

A FAMILY BACKGROUND A statement about the patient s parents and other members of his early household Ages of parents state of health past physical and emotional illnesses and important events with patient s age at the time

B SIBLINGS Number of mother s pregnancies number of siblings sex state of health illnesses or other problems patient s position in sibling group

C MARITAL HISTORY A statement about the patient s spouse and children including ages state of health illnesses or other problems and emotional relationships

D FAMILIAL INCIDENCE of allergy arthritis bleeding dis orders cancer diabetes mellitus epilepsy hypertension kidney disease migraine nervous or mental disorders peptic ulcer rheumatic fever tuberculosis and other dominant patterns of illness

4 Socio environmental History

A SCHOOLING RELIGIOUS ACTIVITY AND MILITARY SERVICE should be described when pertinent

B OCCUPATIONAL HISTORY Describe the patient s activi ties both in and out of the home including recreational interests Note how the patient s work may have played a part (toxins tensions trauma) in his illness and how his illness may in the future affect his customary activities

C Living arrangements A statement about the physical and social aspects of the patient s living quarters

D Special features related to this illness Include a consideration of finances changes in home and work sexual outlets use of drugs or alcohol and the major ways of reacting emotionally to this illness

5 Past Medical History

A General health and strength How does the patient evaluate himself? Would he rate his experience and capacity as average below or above average?

B Birth and early development A statement about birth feeding growth behavior and environment with emphasis on major events and interpersonal relationships during the patient s early years

C Past illnesses communicable or otherwise Childhood diseases and sequelae communicable diseases previous hospital admissions immunizations allergic or hypersensitivity reactions including drug reactions

D Operations injuries accidents Give the date circumstances and nature of surgical procedures A comment regarding type of anesthesia may be of value Functional results should be noted

E Drugs medications habits Note any drugs or medications taken regularly or frequently Inquire about tea coffee soft drinks alcohol tobacco and laxatives

6 Review of Systems

This section constitutes a brief review of pertinent symptoms and signs which may reflect underlying diseases Only abnormal symptoms signs and pertinent normals should be recorded

A Skin hair nails Changes in character consistency or pigmentation pruritus eruptions hives sores

B Head Characterize headaches vertigo syncope trauma

1) *Eyes*—visual acuity corrective lenses photophobia diplopia inflammation

2) *Ears*—pain discharge deafness tinnitus

1 Chief Complaint

A brief statement in his own words if possible of what *concerns the patient most and how long he has been ill*

2 Present Illness

When why and how did the patient become ill? This should be a detailed but concise chronological account of all historical information directly relevant to the onset and course of the illness The patient s concept of his illness and what he hopes to gain from his visit should be recorded

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D FAMILIAL INCIDENCE of allergy arthritis bleeding disorders cancer diabetes mellitus epilepsy hypertension kidney disease migraine nervous or mental disorders peptic ulcer rheumatic fever tuberculosis and other dominant patterns of illness

4 Socio environmental History

A SCHOOLING RELIGIOUS ACTIVITY AND MILITARY SERVICE should be described when pertinent

B OCCUPATIONAL HISTORY Describe the patient s activities both in and out of the home including recreational interests Note how the patient s work may have played a part (toxins tensions trauma) in his illness and how his illness may in the future affect his customary activities

C LIVING ARRANGEMENTS A statement about the physical and social aspects of the patient s living quarters

D SPECIAL FEATURES RELATED TO THIS ILLNESS Include a consideration of finances changes in home and work, sexual outlets use of drugs or alcohol and the major ways of reacting emotionally to this illness

5 Past Medical History

A GENERAL HEALTH AND STRENGTH How does the patient evaluate himself? Would he rate his experience and capacity as average below or above average?

B BIRTH AND EARLY DEVELOPMENT A statement about birth feeding growth behavior and environment with emphasis on major events and interpersonal relationships during the patient s early years

C PAST ILLNESSES COMMUNICABLE OR OTHERWISE Childhood diseases and sequelae communicable diseases previous hospital admissions immunizations allergic or hypersensitivity reactions including drug reactions

D OPERATIONS INJURIES ACCIDENTS Give the date circumstances and nature of surgical procedures A comment regarding type of anesthesia may be of value Functional results should be noted

E DRUGS MEDICATIONS HABITS Note any drugs or medications taken regularly or frequently Inquire about tea coffee soft drinks alcohol tobacco and laxatives

6 Review of Systems

This section constitutes a brief review of pertinent symptoms and signs which may reflect underlying diseases Only abnormal symptoms signs and pertinent normals should be recorded

A SKIN HAIR NAILS Changes in character consistency or pigmentation pruritus eruptions hives sores

B HEAD Characterize headaches vertigo syncope trauma

1) *Eyes*—visual acuity corrective lenses photophobia diplopia inflammation

2) *Ears*—pain discharge deafness tinnitus

3) *Nose*—epistaxis discharge obstruction sinusitis sense of smell
4) *Mouth and throat*—status of teeth gums dentures sores or leukoplakia sore throats hoarseness tonsillectomy adenoidectomy

C RESPIRATORY Cough hemoptysis sputum amount and character use of tobacco or other respiratory irritants chest pain dyspnea cyanosis tuberculosis asthma pneumonia dates of all chest x rays

D CIRCULATORY Angina symptoms of congestive failure exertional dyspnea orthopnea edema, arrhythmias peripheral vascular disease blood pressure changes

E GASTROINTESTINAL Appetite hours and habits of eating dysphagia vomiting jaundice bowel habits diarrhea constipation character of stools blood in stools abdominal pain

F URINARY Frequency urgency nocturia dysuria pyuria hematuria colic hesitancy dribbling incontinence calculi enuresis

G REPRODUCTIVE *In the female*—Menarche menstrual history pregnancies abnormal pain vaginal bleeding or discharge breasts venereal disease frigidity or impotence Date of last menstrual period and previous menstrual period *In the male*—note especially libido potentia (capacity for sustained erection and satisfactory orgasm) and fertility

H MUSCULOSKELETAL Deformities arthritis fractures pain limitation of motion weakness wasting or tremors

I NEUROLOGIC Headaches syncope seizures aphasia loss of sensation pain ataxia weakness or paralysis

J HEMOPOIETIC Anemia transfusions hematinics abnormal bleeding or bruising lymphadenopathy

K METABOLIC AND ENDOCRINE Growth and development normal weight and major fluctuations temperature intolerance nervousness sweating glycosuria polydipsia polyuria voice change change in hair distribution or amount

L PSYCHOLOGIC Childhood behavioral problems nervous breakdowns anxiety depression irritability insomnia alcoholism psychosexual adjustment and maturity

PHYSICAL EXAMINATION

This is an objective record of the physician s measurements and observations in contrast to the historical record provided by the patient Record 1 word or more for each major heading but these may be limited to abnormal findings and pertinent normal features Diagrams or charts frequently are helpful in describing observations and localizing findings

1 Vital Signs

Temperature pulse rate respiratory rate blood pressure (indicate position and arm) Also record height and weight when possible

2 Appearance and Behavior

This should be an accurate description of the patient as an individual including the following information

A MENTAL STATE State of consciousness orientation mood attitude attention memory
B LANGUAGE Quality of speech content coherence
C POSTURE Position in bed dress and appearance
D PHYSIQUE Constitution nutritional status hydration color edema if present
E APPARENT SEVERITY AND DURATION OF ILLNESS
F ATTITUDE AND EMOTIONAL STATE in relation to illness and to the examiner

3 Integument

A SKIN Complexion texture turgor pigmentation eruptions petechiae tumors or nodules
B NAILS Color clubbing
C HAIR Color texture distribution

4 Lymph Nodes

A GENERAL Local or generalized enlargement discrete or matted mobility tenderness
B LOCATION Anterior and posterior cervical pre and post auricular occipital supraclavicular axillary epitrochlear iliac inguinal femoral

5 Head

A. Scalp Tenderness scars
B Skull Configuration depressions or exostoses

6 Eyes

A General Exophthalmos ocular tension
B Lids Ptosis lid lag
C Sclerae Jaundice hemorrhages
D Conjunctivae Pallor injection petechiae
E Cornea Scars ulcerations arcus senilis
F Pupils Size shape equality reaction to light and in accommodation extra ocular movements
G Vision Acuity visual fields by confrontation color perception If glasses are worn, note defect and type of correction
H Fundi Optic discs arteries hemorrhages exudates

7 Ears

A External Tophi, discharge
B Internal Canal walls tympanic membranes fluid behind drums
C Auditory acuity Bone vs air conduction

8 Nose

Shape septum congestion discharge polyps patency of airways sinus tenderness transillumination

9 Mouth and Throat

A General Breath hygiene
B Lips Color cyanosis cheilosis herpes
C Teeth Number caries dentures
D Mucous membranes and gingivae Pallor ulceration, pigmentation enanthem
E Tongue Color papillary atrophy deviation tremor ulceration
F Pharynx Tonsils epiglottis palatal movement

10 Neck

A GENERAL Mobility meningismus
B BLOOD VESSELS Engorgement of veins carotid pulsations abnormal pulsations scars
C THYROID Size nodules bruit
D TRACHEA Position tracheal tug

11 Breasts

Symmetry masses scars nipples secretion pigmentation tenderness

12 Chest and Lungs

A INSPECTION Shape symmetry contour of rib cage anterior posterior diameter expansion (note quality of expansion)
B PALPATION Tactile fremitus
C PERCUSSION Resonance descent of diaphragms supraclavicular spaces
D AUSCULTATION Breath sounds prolongation of expiration rales rhonchi post tussive rales friction rub

13 Heart

A INSPECTION Pulsations apical impulse precordial bulge
B PALPATION Confirm position of apical impulse thrills sounds
C PERCUSSION Map out heart size and other densities
D AUSCULTATION Rate rhythm sounds gallop rhythm murmurs friction rubs

14 Abdomen

A INSPECTION Shape scars veins peristalsis
B PALPATION Liver spleen kidneys colon bladder uterus tenderness rebound tenderness and referred rebound tenderness costovertebral angle tenderness tone (spasm involuntary guarding rigidity) masses hernias
C PERCUSSION Liver spleen and bladder shifting dulness fluid wave tympany size and shape of masses

D AUSCULTATION Peristalsis gastric succussion splash
E OTHER SIGNS OF PERITONEAL IRRITATION Obturation psoas spasm

15 Genitalia

A MALE Distribution and amount of pubic hair fore skin (circumcised?) adhesions penile scars inflammation discharge urethral stricture testes and epididymes size masses descent varicocele hydrocele
B FEMALE Distribution and amount of pubic hair external genitalia size of clitoris glands urethra introitus pelvic relaxation inflammation discharge vagina cervix, uterus adnexa

16 Anus and Rectum

Sphincter tone hemorrhoids prolapse fissure fistula prostate masses presence or absence of blood on examining finger

17 Extremities

A. UPPER Color of palms moisture joint swelling inflammation deformity fractures irregularities limitation of function nodules
B LOWER Equality of leg lengths mobility swelling inflammation deformity of joints fractures measure circumference and length of extremities when indicated

18 Peripheral Vessels

Palpate and describe major vessels and describe amplitude character and equality of pulsations (note particularly posterior tibial and dorsalis pedis arteries) color and temperature of feet edema varicose veins venous engorgement abnormal vascular patterns thrills bruit

19 Back and Spine

Posture mobility curvature tenderness root pain meningismus pilonidal sinus

20 Nervous System

A CRANIAL NERVES Brief survey numerically unless performing a detailed formal neurologic examination in which case consult Appendix D 3

B MOTOR SYSTEM Muscle tone, strength wasting con tracture fasciculation involuntary movements power spasticity clonus

C REFLEXES Deep tendon reflexes superficial and plantar reflexes abnormal signs (Babinski Hoffman Chvostek Trousseau etc)

D SENSATION Touch pain vibration joint position Romberg s sign

E COORDINATION Stance ataxic spastic or festinant gait

F AUTONOMIC NERVOUS SYSTEM Sweating flushing blanching

PRELIMINARY LABORATORY STUDIES

The initial hematologic studies urinalysis stool examination for occult blood and emergency studies bearing on the initial working diagnoses and management should be recorded

SUMMARY OF POSITIVE FINDINGS AND FORMULATION

This should consist of a brief paragraph in which significant historical and objective features are discussed together with a statement about the patient s personality and his reaction to the situation (See Appendix C)

WORKING DIAGNOSES

Diagnoses are tentative and based on the history physical examination pertinent preliminary laboratory studies and any other information which may affect the patient

PLAN OF INVESTIGATION AND TREATMENT

Plans for the further study and management of the patient s problems should be outlined in order of decreasing importance Unusual procedures should be justified briefly (See Appendix C)

D AUSCULTATION Peristalsis gastric succussion splash
E OTHER SIGNS OF PERITONEAL IRRITATION Obturation psoas spasm

15 Genitalia

A MALE Distribution and amount of pubic hair fore skin (circumcised?) adhesions penile scars inflam mation discharge urethral stricture testes and epi didymes size masses descent varicocele hydrocele
B FEMALE Distribution and amount of pubic hair ex ternal genitalia size of clitoris glands urethra in troitus pelvic relaxation inflammation discharge vagina, cervix, uterus adnexa

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Sphincter tone hemorrhoids prolapse fissure fistula prostate masses presence or absence of blood on exami ning finger

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A UPPER Color of palms moisture joint swelling in flammation deformity fractures irregularities limi tation of function nodules
B LOWER Equality of leg lengths mobility swelling inflammation deformity of joints fractures measure circumference and length of extremities when indicated

18 Peripheral Vessels

Palpate and describe major vessels and describe amplitude character and equality of pulsations (note particularly posterior tibial and dorsalis pedis arteries) color and temperature of feet edema varicose veins venous en gorgement abnormal vascular patterns thrills bruit

19 Back and Spine

Posture mobility curvature tenderness root pain men ingismus pilonidal sinus

20. Nervous System

A. CRANIAL NERVES. Brief survey numerically unless performing a detailed, formal neurologic examination, in which case consult Appendix D-3.
B. MOTOR SYSTEM. Muscle tone, strength, wasting, contractures, fasciculation, involuntary movements, power [illegible].
C. REFLEXES. Deep tendon reflexes, superficial and plantar reflexes, abnormal signs (Babinski, Hoffman, Chvostek, Trousseau, etc.)
D. SENSATION. Touch, pain, vibration, joint position, Romberg's sign.
E. COORDINATION. Station, ataxia, spastic or festinant gait.
F. AUTONOMIC NERVOUS SYSTEM. Sweating, flushing, blanching.

PRELIMINARY LABORATORY STUDIES

The usual hematologic studies, urinalysis, stool examination, [illegible] blood, and emergency studies bearing on the initial working diagnoses and management should be recorded.

SUMMARY OF POSITIVE FINDINGS AND FORMULATION

This should consist of a brief paragraph in which significant historical and objective features are discussed, together with a statement about the patient's personality and his reaction to the situation. (See Appendix C.)

WORKING DIAGNOSES

Diagnoses are tentative and based on the history, physical examination, pertinent preliminary laboratory studies, and any other information which may affect the patient.

PLAN OF INVESTIGATION AND TREATMENT

Plans for the further study and management of the patient's problems should be outlined in order of decreasing importance. Unusual procedures should be justified briefly. (See Appendix C.)

3 Special Features of the Evaluation of Children

INTRODUCTION

The evaluation of children is distinctive in that—

1 The history is obtained second hand
2 Parental concern introduces bias to medical information being sought.
3 Due to the child's complete dependence the doctor must understand and enlist cooperation of the parents
4 The velocity of certain disease processes is variable depending on such factors as the resilience of youth the status of immunity the reserve function of organ systems past experience etc
5 There is increased emphasis put on early recognition anticipation, and prevention of disease
6 A search is made for factors affecting optimal emotional neurologic, and physical growth and development

THE PEDIATRIC HISTORY

Actually the emphasis and detail of the initial pediatric history vary greatly with the presenting problem i.e (1) *emergency hospital admission (2) elective hospital admission* (3) outpatient diagnostic work up or (4) well baby supervision Certain situations require exhaustive inquiry at the time of the initial visit (especially when the informant may be absent later on) in others an adequate history is obtained only after repeated contact The history must be regarded as a flexible dynamic aid in the management of the patient The doctor must adapt to the situation keeping 2 basic goals in mind (1) establish a sound working relationship with parents and child (2) assemble the information pertinent to meeting the needs of the child

To achieve these basic goals in the wide gamut of problems that occur in pediatrics the doctor must be tactful perceptive and above all an attentive listener Often important information particularly in emotional problems can be uncovered most easily when the child is being entertained outside Thus the informant is not distracted or reluctant to discuss the problem fully Tactful inquiry into the family's philosophy and practices regarding the patient s feeding toileting disciplining and sleeping may reveal the crux of the problem to both doctor and parents

The record of the present illness is composed *after* all available information has been considered to depict *logically concisely* and *chronologically* a picture of the disease process The concluding paragraph should give a summary of information pertinent to a consideration of the differential diagnosis The historian must decide whether information of borderline importance adds sufficiently to the comprehension of the patient s problem to be included in the present illness or not (and therefore relegated to the past history)

Additions to or correction of the record of the present illness are frequently necessary and should be made either as progress notes or amendments to the original history in the form of dated and signed marginal notes

The recorded history is modified from the Basic Outline in the following respects

1 Chief Complaint and Present Illness

In the case of sick children there is no deviation from the usual form Well children frequently have no Present Illness Usually one includes an initial paragraph indicating the stated reason for the visit and noting any queries raised by the informant The actual cause for concern may not be immediately apparent to either the interviewer or the informant

2 Family History

Inseparable from socio-environmental history

A MEDICAL

1) *Parents*—age and health

2) *Record of mother's pregnancies names ages and health of siblings*
3) *Familial diseases* as listed on page 40 and congenital anomalies muscular dystrophies deaths in early infancy The family tree approach is preferable when exhaustive inquiry is indicated

B THE FAMILY UNIT
1) *Members of patient's household* note ethnic and cultural extraction If home is broken what is relation to it of absent members?
2) *Changes in family structure* (e g new additions deaths) as related to age and adjustment of patient
3) *Changes in dwelling place* as related to age and adjustment of patient
4) *Patterns of family living*—religion discipline amusements use of alcohol etc
5) *Nature of interpersonal relationships*—relation of parents to each other attitude of parents to child attitude of child to parents

C SOCIO-ENVIRONMENTAL STATUS
1) *Description of home*—number of rooms bathroom toilet sleeping facilities screens
2) *Description of neighborhood*
3) *Financial situation*
a) Occupation of father—type of work salary steadiness of income
b) Occupation of mother—if working who looks after the family
c) Other sources of income medical insurance
d) Others supported by this family
4) *Sources of milk and water*

3 Past History (includes Review of Systems)

A chronological statement of normal and abnormal development prophylactic measures and illnesses organized according to the following plan in such detail as is appropriate to the age of the child

A PRENATAL How did mother feel during pregnancy optimistic and active or discouraged and weak? When was prenatal medical supervision begun? General state of maternal health—diet weight gain blood type (*in*

cluding Rh) and serology anemia medication Complications (give approximate dates) (1) emesis and dehydration (2) illnesses and infections (3) irradiation (4) vaginal bleeding (5) operations—anesthesia (6) injuries—shock (7) albuminuria edema hypertension (8) premature labor

B BIRTH Place duration of gestation type of delivery duration of labor birth weight immediate complications (apnea cyanosis hemorrhage obvious injury)

C NEONATAL Weight loss early weight gain circumcision complications (jaundice pallor cyanosis hemorrhage rash convulsions infection diarrhea vomiting fever)

D FEEDING Early adjustment breast or bottle—reasons for early change type and amount of formula vitamins and other supplements solids weaning Present diet

E GROWTH AND DEVELOPMENT Gain in weight and height age in months when baby smiled responsively rolled from supine to prone sat unsupported pulled self to standing position said 3 words walked unaided achieved diurnal and nocturnal sphincter control handling of toilet training by parents adequacy of present speech development in relation to other children present grade in school (if behind for age why?) signs of adolescence

F PROPHYLAXIS AND SKIN TESTS Time (age) of initial immunizations and boosters diphtheria pertussis tetanus smallpox poliomyelitis typhoid fever influenza other Dates of and reasons for gamma globulin antitetanus serum Dates and results of tuberculin and other skin tests Reactions to any of these?

G ILLNESSES

1) *Childhood diseases and sequelae*—chickenpox German measles measles scarlet fever and other streptococcoses exanthem subitum mumps whooping cough

2) *Other communicable diseases* —including impetigo meningitis encephalitis infections of eyes ears nose and throat, cervical adenitis croup pneumonia gastroenteritis diarrhea intestinal parasites fever glandular enlargement jaundice inquire specifically concerning growing pains rheumatic fever nephritis urinary tract infections

3) *Accidents poisonings operations*

4) *Allergies drug reactions*—what drugs has the child received?

H Personality and behavior General statement eating habits sleeping habits behavior at home and with other children adjustment at school Crying thumb-sucking enuresis and encopresis nail biting tantrums jealousies

I Review of systems See Pages 15 and 16 and Appendix A 5 page 43

PHYSICAL EXAMINATION OF CHILDREN

Cooperation by a young child during physical examination though not always possible is usually obtained by gentleness and understanding One should carry out the least disturbing features—palpation of the abdomen examination of the chest —first (frequently with the child in the mother s lap) and reserve the most unpleasant procedures such as examination of the throat and ears and most measurements for last Brennemann s *Practice of Pediatrics* Volume I Chapter 19 is recommended as a ref rence

The general form of recording the Physical Examination is followed Certain features deserve special comment

1 Measurements

In addition to vital signs record weight crown heel length (under 6 years) height (6 years and over) greatest head circumference (under 3 years), thorax circumference at xiphoid and crown rump length (under 6 months) Indicate percentile for each measurement include appropriate ones on special *pediatric growth chart*

2 Appearance and Behavior

In the case of well infants and young children this includes a quasi objective developmental appraisal (See Appendix D 2) In newborns describe position of comfort The appearance and activity of infants should be observed while they are completely naked

3 Head

In infants describe appearance (shape relative size) craniotabes bossing fontanels (size tension) sutures In newborns describe molding caput succedaneum cephalhematoma

4 Chest

Note costochondral junctions

5 Genitalia

Male infants palpate for thickened spermatic cord containing peritoneum (hernia) *Female infants* look for filmy posterior synechia of labia minora

6 Anus and Rectum

Digital examination is done only on special indication

7 Extremities

Palpate simultaneously radial and femoral arteries in young infants check for symmetrical abduction of flexed hips

APPENDIX A
The History

APPENDIX A 1
An Approach to the Patient

Health and disease may be regarded as 2 phases of the life long process of adaptation When a patient consults a physician unless it be for a routine examination it is because he has perceived or fears some disturbance in his well being and it is the task of the physician to determine insofar as possible the nature of this imbalance and to help the patient in achieving his best level of adjustment Implicit in this approach is the concept that the individual functions at many levels of adaptation which are mutually interdependent and that he may or may not be aware of the primary level of decompensation This may be at the enzymatic cellular organ humoral neurologic psychologic or social levels A disturbance at one level influences adjustments at other levels and necessitates some evaluation of the adaptive processes utilized by the patient at all levels Considered in more humanistic terms it is the doctor s function to understand to alleviate suffering and to help restore function and where possible to prevent illness and improve health standards

The achievement of these goals depends primarily on the physician s ability to understand and manipulate the physician patient relationship to the maximum advantage of the patient This relationship is initiated during their first meeting and consists of the interview and the physical examination At one time the interview was regarded merely as an opportunity for fact finding and the physician tended to conduct it in a stereotyped question and answer fashion but the complexity of the human organism makes it impossible to cover all the important

areas by this technique Moreover the patient usually has little understanding of the real basis for his symptoms and difficulties and in addition much of the physician s information is derived from the manner in which the patient presents himself and tells his story

When a patient initially meets a physician or enters the hospital he is anxious puzzled and wonders what is to happen to him and his personal affairs Some patients have procrastinated for weeks or months before consulting a physician others have developed anxiety and terror in response to minimal stimuli Whatever its sources the anxiety is usually accompanied by the wish to be helped by some powerful authoritarian figure by feelings of guilt and by a resurgence of old and frequently childish attitudes These and many other feelings and attitudes interfere with the patient s capacity to tell his story in a calm logical coherent fashion The initial goal of the interview therefore is to establish an appropriate relationship with the patient—to develop rapport — so that the patient and physician may communicate effectively It is necessary for the physician to realize that he is both a participant and an observer and the manner in which the interview proceeds therefore will be not only a function of the patient and his problems but also a function of the physician and his attitudes

It is of prime importance that the doctor have an attitude which generates confidence and understanding He should convey to the patient the impression that he has ample time and that he is interested in him as an individual and not just as another case or disease However rushed the physician may be time will be saved in the long run if the patient feels that the physician is unhurried Important symptoms fears and problems frequently are revealed by the patient only when he feels that the physician has time to listen So far as possible the interview should be conducted in complete privacy and under the pleasantest conditions and surroundings available Patients in wards or semiprivate hospital beds should be taken to a private examining room for the interview whenever possible Taking of notes in the presence of the patient is to be avoided if possible if necessary to the examiner it is helpful to discuss it with the patient and then make the recording of notes as unobtrusive as possible

The second purpose of the interview is the appraisal of the patient and his problems This is based initially on the medical history which in essence is a brief biography of the patient s life and is the major source of information leading to the diagnosis of the disease understanding of the person and the treatment of the patient and his illness The accuracy of diag nosis frequently depends upon the quality of the history and the competence with which the interview is conducted These in turn are a function of the physician s knowledge of disease and human behavior and of his skill in eliciting information from the patient

After the opening amenities and with the patient as com fortable as possible it is appropriate to begin the interview by such questions as What brings you to the hospital? What seems to be the trouble? or How may we help you? It usually is wise to avoid negative approaches such as What is wrong with you? or What is the matter with you? because of the critical alarming or moralizing connotations From the patient s viewpoint the telling of his life story is an intense personal experience which may be filled with anxiety and guilt or relief and pleasure It is important therefore to allow the patient to tell his story with as few interruptions as possible Some patients may however require more skillful guidance and questioning

The physician should be alert not only to the actual con tent of what the patient says but also to the manner of presen tation and the behavior and appearance of the patient at the time Often relationships are revealed by the order in which the patient presents material The fact that 1 topic leads to another suggests that there is some connection between them even though the patient is unconscious of any association The physician should note obvious omissions of pertinent material or persons from the history Emotionally charged material will be indicated by various behavioral mannerisms of the patient such as blushing stammering slips of the tongue pauses evasions vagueness of detail etc It is well to remember that the primary stress whether it be a bacterial invasion the in gestion of a poison the growth of a tumor or the presence of an intolerable aggressive impulse usually is unknown to the patient, and hence the physician is constantly seeking the indirect evidence of its presence The examiner then must

constantly pick up clues from what the patient says how he behaves as he says it and what he fails to say

As experience in clinical medicine grows the interview becomes a deductive process in which the physician forms hypotheses gathers evidence and follows the leads which confirm or negate the hypotheses As he proceeds he organizes a preliminary differential diagnosis on which to focus later attention This type of interviewing becomes a much more active process than the mere accumulation of data Activity during the interview should not be equated with more vigorous questioning or participation by the physician The skilled physician spends most of his time listening to the patient and very little in talking himself He has become sufficiently familiar with sick people to know what questions to ask and when and how to ask them Skill in maintaining both control and flexibility during the interview should be learned and perfected Frequently a glance a lift of the eyebrows or the repetition of a key word will be sufficient to lead the patient into pertinent discussion of an important area With experience in interviewing significant data about the present illness past history the patient s interpersonal relationships his feelings about his illness and other significant details will be obtained

Toward the conclusion of the interview it is usually necessary to review the history fill in details about certain areas ask specific screening questions and follow up leads which the patient has provided There will be many occasions especially relating to primarily organic diseases when it is pertinent to ask highly specific direct questions For example in the case of a fracture it is necessary to obtain a precise description of the location and type of pain whether or not there is any disturbance of sensation peripherally where and when the accident occurred whether there has been a history of frequent fractures etc Other screening qu stions will be asked during the review of systems this may be done either during the course of the interview or at the time of the physical examination Rapport between the physician and patient tends to be intensified by the close physical contact of the examination and further questioning at this time is often productive It is important to observe the patient s behavior during the physical examination in addition to the particular area being examined

The third part of the interview may be thought of as motivating the patient to continue the physician patient relationship for the purpose of further evaluation and therapy At the end of the interview then the patient s attention should be again focused on the presenting complaints and the patient should be given an opportunity to ask questions or add any additional information At this time it is generally useful to ask the patient to express his opinion about his problem Frequently patients reply by saying Well you re the doctor To this the physician may reply Yes but you are the one who has dealt with this problem for the longest period of time and in many ways may know the most about it The physician should avoid giving premature reassurance judgment and interpretations in the long run this usually tends to diminish rather than strengthen confidence in the physician It is of great importance to leave the patient with the feeling that it may be important to talk further about his difficulties Before the interview is closed he should have some clear understanding of future plans for the relationship and an indication of continued interest on the physician s part

It is usually advisable to interview 1 or more of the patient s relatives to obtain confirmatory data or fuller explanations They may be able to provide further information about symptoms treatment and behavior of which the patient is unaware In addition it frequently will be important to have the family s full cooperation in the management of the patient after he leaves the hospital

The medical history is a literary composition involving the organization and presentation of data in clear scientific logical and concise form It should also be an interesting human document and may utilize many of the patient s own words in quotation marks It is improper to employ humorous or undignified language and it is important to remember that the record is a formal legal document which may be subject to summons by courts of law The history cannot be written from a completely objective point of view since the physician is attempting to concentrate and arrange systematically the varied information available Pseudoscientific documentation should be avoided but precision and accuracy are desirable The bulk of the data in the history are derived ultimately from what the patient or his relatives communicate to the physician and are

subject to wide variations of human error and distortion It is the physician s task to interpret the meaning of the patient s communications nonverbal as well as verbal to establish the significance of the relationship that exists between seemingly unrelated facts and to construct from this a reasonably syste matic and coherent story

APPENDIX A 2

The Present Illness

GENERAL

This section should attempt to answer the questions When why and how did the patient become ill? It is essential to date the onset of the present illness as clearly as possible whether this be 30 years or 2 hours before admission and this time should be used consistently throughout the history If the patient has had previous admissions to the hospital these should be summarized concisely in chronological order When the admissions relate to the Present Illness a subheading—Previous Hospitalizations—is indicated at the beginning of the Present Illness When they relate to other illnesses they should be described under a separate heading—Previous Hospitaliza tions The dates of admission and discharge the final diag noses and a concise summary of the hospital course should be given for each admission An Interval History may be used to describe the patient s health since the last hospitalization if previous ones were in the same hospital

Many patients may find it extremely difficult to date the onset of their illness but an answer to the question When did you last feel perfectly well? is frequently helpful Other patients may be helped by relating symptoms or illnesses to prominent events e g Christmas vacations marriages deaths the Great Depression outbreak of a war etc The decision to place data in the Present Illness or in the Past Medical History or Review of Systems is frequently variable For ex

ample a patient with diabetes of 15 years duration may be admitted with an upper respiratory infection of 2 days duration and the diabetes may be discussed in the Present Illness in the Past Medical History or in the Review of Systems depending upon the nature of the Chief Complaint and the presenting problem It would be essential to indicate at the outset that the patient is diabetic

The order of presentation of data in the Present Illness is flexible For example in prolonged illnesses such as tuberculosis it may be necessary to organize the Present Illness chronologically by years or by months indicating the patient s progress step by step In other instances such as progressive heart failure the Present Illness may be organized chronologically according to the development of symptoms and the relationship of underlying rheumatic fever for example may be indicated in the Present Illness or in the Review of Systems It is always well to orient the reader by indicating when the patient observed his first deviation from health This frequently precedes the onset of the symptoms given as the Chief Complaint

The Present Illness should be a complete sequential and factual account of all the factors events symptoms and reactions which have characterized the onset progression exacerbation or course of the illness For the most part no interpretation is made although the examiner should keep in mind that he is attempting to answer a number of important questions To what disease agents, traumata stimuli, or stresses has the patient been exposed? Why did the illness develop at this particular time and not some weeks earlier or a few days later? Has the patient been exposed to any source of contagion among his family at work or as a result of travel? *Obtain precise details with dates and descriptions of the illnesses* What was the emotional and social climate at the onset of the illness? What treatment has the patient taken himself or been given by other physicians? This should be described as accurately as possible in terms of dosage frequency nature of treatment duration and reaction Why did the patient seek help at this time rather than postpone it or seek it earlier? If the patient is referred from another physician why is he being referred at this particular time? Does the Chief Complaint represent the real problem? Frequently it is only an excuse for

consulting the physician for some deeper problem Is the presenting complaint part of an acute a chronic or a recurrent maladaptation or is it some new departure from health? What secondary complications have developed in relation to the basic difficulty? The patient may manifest marked anxiety or denial in response to a somatic disease or he may develop a somatic symptom in response to a stressful life situation It usually is important in the Present Illness to give some evaluation of all the possible factors impinging upon the patient, whether they be physical chemical infectious climatic social or emotional

Each change in symptoms or each chronological period in the Present Illness should be paragraphed and the outstanding symptoms underlined to provide further clarity Time should be related to the onset of the Present Illness the month and year may be included but days of the week should not be used except to indicate events recurring on certain days of the week e g migraine headaches on Sundays If recurrent symptoms have suggested seasonal incidence as in allergic diseases these should be indicated by using the names of the months or if there is a relationship to changes in the patient s pattern of living e g crops income tax time vacations Christmas etc it should be stated clearly

It is important to estimate in general how sick the patient is and also to obtain some estimate of how sick the patient thinks he is This may be determined by inquiring whether he has observed such complaints as irritability fatigue weakness frustration anxiety or depression How much has the illness interfered with his work exercise relaxation and sleep? Has it confined him to bed? Is he too ill to go to the bathroom? The illness may circumscribe his social activities his work his domestic responsibilities his marital life or all physical activity Particular symptoms and signs are defined by describing such features as onset duration recurrence periodicity character of sensation site radiation factors producing exacerbation or relief associated symptoms or activities and response to therapy Pain for example is described by giving its location radiation character (sharp colicky burning dull gnawing) severity (mild moderately severe, excruciating requiring morphine causing the patient to double up or cry out) duration (constant intermittent periodic) time of occurrence

(1)	Jan	John (4) Patient	Tom (2)	Mary (8)	Mother (32)	Father (33)
	4					Sudden onset acute tonsillitis Fever subsided ½ day after starting i m pencillin
	5					
	6			Has been well	Has been well	
	7					
	8	Head cold with sore throat mild fever				
	9					
	10		Head cold slight intermittent fever anorexia			
	11					
	12					
	13					
	14					Back to work
	15					
	16					
	17					
	18					
	19	Onset of painless hematuria puffy eyes				

20	
21	
22	Admitted to hosp

(2)

Date	Age	Event	Symptoms
1934	14	Summer camp	Loss of appetite and weight
1942	21	Shortly after honeymoon	Acute episodes of epigastric pain—relieved by food and alkalis
1947	26	Death of mother	Depressed for 8 months Worked only intermittently
1949	28	Started own grocery business	Recurrent epigastric pain postprandial Started on antispasmodics sedatives antacids by physician
1950 52	29 32	Much worry about business	Frequent exacerbations of ulcer symptoms and tarry stools
1953 Oct	33	Overexpanded business and in debt	X ray in OPD showed active duodenal crater
1956 Mar	36	Worried about income tax and pregnancy of wife	Ulcer symptoms worse accompanied by progressive nausea and vomiting

(relation to what circumstances or events relieved increased produced by meals bodily functions position exertion rest heat cold anxiety or medication, etc), association with additional symptoms (nausea, vomiting diarrhea chills fever cough sweating prostration) interference with work sleep meals *Frequently the patient will need assistance in clarifying such complaints as pain in the side dizziness cold stomach trouble* etc When the patient s description of symptoms or signs is clear and graphic however his own words may be quoted and accompanied by further explanation of essential details Lay terms and diagnoses when used in the history should be put in quotation marks The examiner should obtain a precise accurate description of each episode of illness and should not accept the patient s statement at face value If the patient states that he was operated on for appendicitis it is important to elicit the precise symptoms and the sequence of events at the time Was a pathologic report obtained? Frequently it will be necessary to consult the physician in charge of the patient at that time or to write to other hospitals for further details A telephone call may save valuable time when it is important to know details about drugs dosages or operations

The Present Illness is usually the most important part of the medical history of a sick patient Discrimination in both eliciting and recording of data is expected a long history is not necessarily a good history It is not essential to list all the normal data but it is important to list those normal features which are relevant to the current problem and to indicate that the various illnesses included in the differential diagnoses suggested by the patient s complaints and history have been thoroughly explored

CLINICAL GRAPHS

Frequently clinical graphs are useful for relating events and symptoms Two examples of these are on pages 36 and 3

APPENDIX A 3

The Family History

This section should describe the human background into which the patient was born and which influenced his constitutional and behavioral development It should also indicate his present close interpersonal relationships There should be brief descriptions of the principal members of the patient s family and the patient s relationships to them discussed The family may be regarded as a unit of interacting persons providing the framework for the patient s childhood and adult relationships It is important to consider the effects both of the immediate family and of all the members of the household upon the patient s development and adjustment Attention should be centered on the family (and household) as a system of human relationships with patterns of love hate authority dominance subordination punishment and reward It is in the family that biologic man develops his individual personality and becomes a social person and the physician needs great sensitivity to the human matrix in which this process has occurred Much of the patient s behavior may need to be understood in terms of the family s values which may be quite different from those of the physician

In ascertaining important events in the family such as births illnesses deaths separations etc it is most important that the patient s age at the time of these events be recorded and that any possible temporal relationship between them and the patient s illnesses be established It is these life situations which frequently provide the stresses to which patients may adapt by illness

FAMILY BACKGROUND

A statement about mother and father and other important figures including age occupation background (ethnic extraction religious national cultural educational) outstanding personality characteristics state of health presence of symp

toms like the patient s approximate dates of illne ses and death (indicate patient s age at the time) nature of terminal illness Was the patient present? Any symptoms of other ill nesses? What is or was the personal relationship of the patient to the parents? Does the patient live with the parents? When did he leave home? Why?

SIBLINGS

Number of mother s pregnancies list first name age state of health occupation marital status of each sibling and note position of patient in the family Frequently a small chart will be helpful Mention illnesses or other problems What is pa tient s relationship to various siblings?

MARITAL HISTORY

1 Spouse

Age occupation background outstanding personality char acteristics and state of health Discuss courtship Date of marriage present status of marriage Indicate any recent changes in the spouse s health occupation behavior etc Give some evaluation of the marriage in the social eco- nomic domestic and sexual spheres

2 Children

Ages health occupation sex marital status of children Are the children living at home? Provide data about symp toms illnesses deaths etc if any

FAMILIAL INCIDENCE OF DISEASE

Consider allergy arthritis bleeding disorders cancer dia betes mellitus epilepsy hypertension kidney disease migraine nervous or mental disorders peptic ulcer rheumatic fever tuberculosis and other dominant patterns of illness Indicate if pertinent all members of the family who have a specific illness Mention family attitude toward illness

APPENDIX A-4

The Socio Environmental History

SCHOOLING RELIGIOUS ACTIVITY MILITARY SERVICE

1 Schooling

At what age did schooling begin? If delayed why? Memory of first day at school Length of schooling Age at end of schooling Reasons for leaving school Did the patient like school? What were his achievements? How did he get along with teachers and other pupils? Was schooling pain ful for him or a satisfying experience?

2 Religious Activity

Denomination? What is the extent and function of church participation for the patient? Is it primarily for moral and spiritual guidance or for the social activity? Or both? Discuss the patient s and family's attitude toward religion Is the patient s conduct at variance with that of his family or social group?

3 Military Service

Dates of enlistment branch of service and record Health in service rank theaters of service and circumstances of discharge General attitude toward authority in all spheres of activity

OCCUPATIONAL HISTORY

State when the patient began to work, describe types of jobs and discuss why any changes were made What is his income level? How is his work valued in terms of prestige and social satisfaction? With whom does he work and how does he relate to them? What are his attitudes toward working hours? His future plans and ambitions? How does he handle

toms like the patient s approximate dates of illnesses and death (indicate patient s age at the time) nature of terminal illness Was the patient present? Any symptoms of other ill nesses? What is or was the personal relationship of the patient to the parents? Does the patient live with the parents? When did he leave home? Why?

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Number of mother s pregnancies list first name age state of health occupation marital status of each sibling and note position of patient in the family Frequently a small chart will be helpful Mention illnesses or other problems What is pa tient s relationship to various siblings?

MARITAL HISTORY

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Age occupation background outstanding personality char acteristics and state of health Discuss courtship Date of marriage present status of marriage Indicate any recent changes in the spouse s health occupation behavior etc Give some evaluation of the marriage in the social eco nomic domestic and sexual spheres

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Ages health occupation sex marital status of children Are the children living at home? Provide data about symp toms illnesses deaths etc if any

FAMILIAL INCIDENCE OF DISEASE

Consider allergy arthritis bleeding disorders cancer dia betes mellitus epilepsy hypertension kidney disease migraine nervous or mental disorders peptic ulcer rheumatic fever tuberculosis and other dominant patterns of illness Indicate *if pertinent* all members of the family who have a specific illness Mention family attitude toward illness

sleeping pattern? Record any dreams and fantasies What is the patient s understanding of his present illness? What is its bearing on his life?

APPENDIX A 5

The Review of Systems

This section provides detailed reviews of the symptoms in each of several regional and physiologic systems At times the review of systems may be concerned with intensive inquiry into the functioning of a particular system and at other times it will primarily constitute a means of screening the patient for the presence of early or latent illness which may be prevented or modified The symptoms in the following paragraphs may be considered when there is a need for detailed evaluation of particular systems

1 Skin Hair and Nails

Type character location and frequency of eruptions changes in color character consistency or pigmentation pruritus bruising petechiae tumors exposure to toxic agents or contactants hives alopecia abnormalities in character quantity or distribution of hair clubbing of nails brittleness fungus infections nail biting

2 Head and Special Senses

A GENERAL Dizziness vertigo or fainting describe the patient s sensations precisely Indicate the character and duration of any loss of consciousness or awareness Indicate whether the symptoms are relieved quickly by lying down By dizzy or faint does the patient mean unsteady or lightheaded? If there is a history of trauma, indicate whether there was associated loss of consciousness and its duration. What was the precise

responsibility and authority? What is his concept of success? Inquire about his exposure to contagion or toxic agents (industrial solvents insecticides cleaning fluids lead paint remover etc) What are his economic resources and reactions to them? Any financial worries or debts? Does he have hospital insurance? What coverage does it provide?

How does the patient employ his leisure time? Has he any secondary skills and interests which he may develop in the event his primary skills are disabled by illness? What are the standards of social behavior sports games parties dances etc? Has he any plan for retirement? Attitude toward need for social contact and esteem of others Does he get along well with people in general?

LIVING ARRANGEMENTS

In what sort of home environment and neighborhood does the patient live? Where does his family live? Does he own or rent? Any recent change in place of residence? What is the home s geographic relationship to his work? How large are the living quarters? How many people live in the dwelling? Has the patient a room of his own? If not, with whom does he share it Are there stairs or other physical aspects in the home which affect the patient s health adversely? It is frequently important from social cultural and epidemiologic viewpoints to list the patient s principal places of residence and the dates he moved

SPECIAL FEATURES RELATED TO THIS ILLNESS

In this section consider any specific changes or problems which might be related to the illness including finances changes in home and work use of drugs or alcohol What are the patient s relationships with other people at work and at home? Any feelings of inadequacy suspicion or concern about how others feel toward him? What are his patterns of sexual outlet? Has there been any change in this? Mention the major ways of reacting emotionally to this illness

How does the patient react when anxious? Is there any increasing level of anxiety? Is there any change in the patient s

Is hearing better in a quiet or noisy environment? Where is hearing best—in groups (theaters churches etc) in conversational situations (single person or groups)? Social adjustment as result of deafness? Is a previous audiogram available? Does patient wear a hearing aid? How well does it function? Any speech pathology associated with deafness or otherwise? Tinnitus (steady clicking or pulsating) pain, discharge vertigo or dizziness does milieu spin floor rise or fall? Are there associated nausea and vomiting?

E NOSE Discharge epistaxis obstruction mouth breathing sinusitis (pain, tenderness or drainage) hay fever frequency and duration of colds use of tobacco chronic use of nose drops or inhalers

F MOUTH AND THROAT Sore mouth sore tongue ulceration, leukoplakia, taste bleeding gums or other mucous membrane lesions dental caries dentures, extractions abscesses pain general condition pain sore throats tonsillitis tonsillectomy (when and for what reason) difficulty in swallowing change in voice hoarseness postnasal discharge or bleeding pain in the ears with swallowing cervical adenitis

3 Respiratory

Cough (duration precipitating factors time of day) dyspnea cyanosis stridor aspiration of food or foreign bodies croup bronchitis asthma pneumonia (if recurrent has it always been on the same side?) tuberculosis exposure or family history of tuberculosis hemoptysis indicate amount, whether blood streaked sputum or gross blood and whether bright or dark inquire about unusual chest pain or associated sensation and indicate location sputum estimate amount in tablespoons cups indicate whether thick, tenacious or watery and color odor exposure to irritating dust, vapors or other noxious agents (e g silos caves manure pigeons bats chickens, etc.) use of tobacco (how much for how long) night sweats chest pain (duration location relation to exertion, meals, respiration cough position emotion etc.) wheeze (duration relation to season, possible allergens climate etc Is

location of the injury? *Were skull x rays taken?* *Was* there drainage of cerebrospinal fluid or blood from the nose or ear? Are there other abnormalities of the scalp or cranium?

B HEADACHE May be described under this heading or under the Neurologic section (I) A detailed description of the headache should be given under the following headings

1) *Location*—localized generalized fronto occipital unilateral facial temporomandibular temporal orbital maxillary root of nose vertical (sphenoid) occipital or nuchal
2) *Character*—steady pulsating lancinating deep or within cutaneous tissues bandlike pressing *etc paresthesias*
3) *Time of onset*—relationship to fatigue emotion tension or pressure hypoglycemia use of eyes smoking alcohol or caffeine time of day day of week time of month relationship to menses seasonal regular or irregular
4) *Relationship* to position of head (cervical arthritis) occupational postures stooping or jarring of head diminished nasal breathing space or sinusitis Improved or aggravated by digital pressure over area
5) *Association* with scotomata diplopia imbalance vertigo nausea vomiting lacrimation change in mood
6) *Family history of headaches*—which member of the family? What were the symptoms? Are the patient s headaches like these?

C EYES Visual acuity corrective lenses photophobia drowsiness double vision difficulties with night vision asthenopia blurring distortion pain scotomata strabismus trauma inflammation discharge itching working conditions especially illumination

D EARS Hearing is deafness associated with acoustic trauma (gun fire machinery etc) aural infections in the past (meningitis syphilis mumps influenza) pregnancy *toxic agents streptomycin salicylates* quinine? Is there associated staggering vertigo difficulty walking in dark diplopia? Duration of hearing difficulty

Is hearing better in a quiet or noisy environment? Where is hearing best—in groups (theaters churches etc) in conversational situations (single person or groups)? Social adjustment as result of deafness? Is a previous audiogram available? Does patient wear a hearing aid? How well does it function? Any speech pathology associated with deafness or otherwise? Tinnitus (steady clicking or pulsating) pain discharge vertigo or dizziness does milieu spin floor rise or fall? Are there associated nausea and vomiting?

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it audible? Does it change with coughing? Does it respond to medication?), dates and results of all chest x rays

4 Circulatory

Fatigue dyspnea relation to exertion position emotion irritants etc duration relation to inspiratory or expiratory phase of respiration paroxysmal nocturnal dyspnea orthopnea air hunger cyanosis (relation to exertion) plethora angina or other chest pain (relation to exertion position emotion etc) palpitation (regular irregular onset and cessation) edema growing pains joint pains history of heart murmur date first observed hypertension date and level of hypertension note previous insurance industrial or military exams results of all chest x rays Varicose veins thrombo embolic disease (phlebitis milk leg emboli) leg ulcers night pains restless legs intermittent claudication gangrene

5 Gastrointestinal

Recent change in appetite or weight relation to food intake hours and habits of eating food intolerance nausea vomiting (color blood volume frequency) heartburn belching bloating air swallowing difficulty (catching) or pain on swallowing dysphagia epigastric abdominal or back pain tenderness (radiation and referral) nocturnal pain jaundice diarrhea hemorrhoids constipation (use of laxatives) mucus or blood in stools tarry bulky or clay colored stools changes in character caliber frequency and timing of stools

6 Urinary

Frequency of urination (day and night) dysuria strangury urgency nocturia polyuria oliguria pain (location and character) pyuria smoky urine hematuria size and force of stream (observe if possible) retention hesitancy dribbling incontinence enuresis edema of face renal colic passage of calculi previous cystoscopies irrigations etc

7 Reproductive

A MENARCHE AND MENSES Age of onset interval between periods duration of flow amount and intensity of flow (this may be indicated as follows 13/28/5 6/ heavy first day) pain dysmenorrhea (location and relation to menses) intermenstrual pain or bleeding record onset dates of last menstrual period (LMP) and of previous menstrual period (PMP) preparation for first menses attitude and response to first period nausea and vomiting at first or subsequent periods Are the nausea and vomiting associated with the onset of flow or with pain? Changes in normal habits with menses? Leukorrhea pruritus postcoital bleeding dyspareunia loss of libido frigidity (absolute or relative)

B PREGNANCY AND FERTILITY Number of years married age at first pregnancy total number of pregnancies (indicate whether term premature or abortions and note the trimester) number of living children (ages of oldest and youngest) general state of health and attitudes during pregnancies nausea vomiting bleeding headache visual difficulties ankle edema, hypertension, albuminuria convulsions or other complications duration of labor difficulties duration of convalescence attitude toward future pregnancies type of contraceptive used and attitude toward it If there is a history of absolute or of relative sterility ask about the attitude of both partners toward it Have they both been studied medically? Questions about menstruation and pregnancy often yield important information about the patient s psychosexual development For purposes of brevity the menstrual and reproductive histories may be arranged according to the outlines used by some departments of Obstetrics and Gynecology

C BREASTS Masses swelling tenderness discharge or pain (note relation to menses pregnancies and nursing) Were children nursed?

D VENEREAL DISEASE Urethral or vaginal discharge genital or mucous membrane lesions (plaques warts chancres and buboes) rashes alopecia inquire about history of syphilis or gonorrhea by name symptoms

or colloquialisms previous serologic tests for syphilis (where when results), lumbar puncture (where when results) antivenereal treatment inquire about intravenous or intramuscular injections and their duration any course of penicillin whether for venereal disease or some other condition should be noted exposure and name of contact if possible

8 Musculoskeletal

Postural deformities congenital anomalies paralysis or weakness old fractures muscle atrophy or weakness girdle *shooting or muscle pains backache or neck ache* pain on walking painful spots on fingers or toes calluses fungus infections of extremities temperature of hands and feet sweating pain stiffness limitation swelling or redness of joints

9 Neurologic

Headache may be described under this section or under Head and Special Senses (B) dizziness syncope seizures (precise description from an observer) loss of sense of smell or taste difficulty in swallowing aphasia speech disturbance stiff neck paralysis facial weakness or other muscle weakness stiffness involuntary movements tremor wasting numbness tingling pain loss of sensation difficulty in walking ataxia loss of bladder or bowel control handedness

10 Hemopoietic

Anemia hematinics (liver iron folic acid B_{12} cobalt etc) history of transfusions and reactions evidence of blood loss blood group abnormal bleeding or bruising lymphadenopathy splenomegaly exposure to lead benzene paint remover irradiation or drugs toxic to the hemopoietic system

11 Metabolic and Endocrine

A NUTRITION AND WEIGHT FLUCTUATIONS Number and character of meals per day review and record com

plete dietary history if indicated (Appendix D 1 p 58) special diets (reduction diabetic bland low sodium etc) inquire about between meal eating consumption of soft drinks alcohol etc food fads and habits Are dietary problems related to emotional cultural social or economic factors? Weight fluctuations and weight distribution record average stable weight and present weight

B ENDOCRINE Consider hyper and hypofunction of the various glands

1) *Anterior pituitary*—abnormalities of growth or generalized endocrine disease
2) *Posterior pituitary*—polydipsia insatiable thirst polyuria (obtain accurate measurements) dehydration
3) *Thyroid*—temperature intolerance perspiration skin hair voice or face changes change in appetite muscular weakness anxiety lethargy history of goiter thyroid or antithyroid medication thyroid surgery thyroid pain tenderness or cysts
4) *Parathyroid*—increased neuromuscular excitability (cramps tetany paresthesias) ectodermal changes hypotonia weakness bone pain renal colic
5) *Gonads*—menstrual irregularities breast changes alterations in libido or fertility changes in secondary sexual characteristics masculinization or feminization
6) *Adrenal hypofunction*—asthenia easy fatigability (particularly late in the day) weight loss increased pigmentation increased salt intake paroxysmal nausea vomiting and prostration
7) *Adrenal hyperfunction*—adiposity of the face neck and trunk with sparing of extremities postural changes (dorsal kyphosis) plethora easy bruising purple striae hirsutism masculinization pseudo precocity

C DIABETES MELLITUS Polydipsia polyuria appetite weight loss peripheral neuritis coma cataracts pruritus history of glycosuria hyperglycemia record diet and type of insulin taken (indicate precise dosage time

or colloquialisms previous serologic tests for syphilis (where when results), lumbar puncture (where when results) antivenereal treatment inquire about intravenous or intramuscular injections and their duration any course of penicillin whether for venereal disease or some other condition should be noted exposure and name of contact if possible

8 Musculoskeletal

Postural deformities congenital anomalies paralysis or weakness old fractures muscle atrophy or weakness girdle shooting or muscle pains backache or neck ache pain on walking painful spots on fingers or toes calluses fungus infections of extremities temperature of hands and feet sweating pain stiffness limitation, swelling or redness of joints

9 Neurologic

Headache may be described under this section or under Head and Special Senses (B) dizziness syncope seizures (precise description from an observer) loss of sense of smell or taste difficulty in swallowing aphasia speech disturbance stiff neck paralysis facial weakness or other muscle weakness stiffness involuntary movements tremor wasting numbness tingling pain loss of sensation difficulty in walking ataxia loss of bladder or bowel control handedness

10 Hemopoietic

Anemia hematinics (liver iron folic acid B_{12} cobalt etc) history of transfusions and reactions evidence of blood loss blood group abnormal bleeding or bruising lymphadenopathy splenomegaly exposure to lead benzene, paint remover irradiation or drugs toxic to the hemopoietic system.

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of day taken and inquire about weakness palpitation sweating prostration or other reactions)

12 Psychologic

Childhood behavioral problems enuresis anxiety emotional lability nervousness nervous breakdowns depression blue spells lethargy fatigue (early or late in the day) phobias impairment of memory insomnia (difficulty *in getting to sleep difficulty in sleeping or* early awakening) sleep-walking tics nail biting delinquent antisocial or unusual behavior

13 Psychosexual Adjustment and Maturity

Much of the data in this section ordinarily will be obtained during the discussions of the reproductive function and the patient s marriage Discretion should be used in discussing (and recording) this material and if it proves disturbing to the patient much of it should be deferred until a later interview Attitudes and reactions during discussion of this area should be observed and recorded they frequently are more revealing than what the patient actually says The following topics are among those which *may be considered* Early sexual instructions curiosity and experiences attitudes of parents toward sex nudity modesty etc Masturbation worry about it? Age of onset of dating Early attitudes toward the opposite sex Premarital sexual exp riences courtship duration difficulties encountered Illegitimate pregnancies Criminal abortions? Is the patient happily married? Difficulties with spouse? Is sexual adjustment satisfactory to both partners Duration and character of foreplay and capacity of partners to achieve orgasm Any increase or decrease in sexual desire during the present illness? Worry about it? Are symptoms *connected with sexual activity? Are they worse* after intercourse? Is the frequency of intercourse satisfactory? If not *already discussed consider frigidity* impotence and premature ejaculation Extramarital relationships? Any homosexual experience? Any perversions?

APPENDIX B

The Physical Examination

Certain features of the physical examination deserving spe cial emphasis are discussed in this section Neither this nor the basic outline is an attempt to be complete for details a text book on physical diagnosis should be consulted

CONDUCT OF THE EXAMINATION

The physician patient relationship will be influenced greatly by the competence thoroughness courtesy and gentleness with which the examination is conducted To most patients a physi cal examination is a more or less uncomfortable experience Some patients are apprehensive because they fear the probable findings Others are apprehensive because of lack of familiarity with the procedure To seriously ill patients the examination may be physically exhausting and judgment and care must be used in deciding its extent

The physician s demeanor and attitude should give no in dication of his findings and discussion of these should be re served until the examination has been completed and the patient has had a chance to recover his composure Technical discussions with colleagues in the patient s presence should be avoided if possible and if unavoidable the patient should be included in the discussion and given suitable explanations rather than ignored Whenever unusual attention to a particu lar part of the examination is necessary special care should be taken to keep the patient s heightened anxiety to a minimum

Particular care and gentleness should be used in eliciting tenderness and in examining painful areas Uncomfortable parts of the examination particularly in dealing with children or in the presence of anxious relatives or friends are best left

to the end As a rule explanation in advance of the necessity for painful examinations and techniques is advisable

All pelvic examinations should be chaperoned Other examinations of women should be chaperoned when possible since some patients particularly those with hysterical tendencies, are prone to see erotic implications in them When help is not available the door should be left open with a suitable screen in front of it This is primarily for the protection of the physician and incidentally for the comfort of the patient Pelvic examinations should be performed on children and adolescent girls only when absolutely necessary to establish a diagnosis

OBSERVATION AND RECORDING OF APPEARANCE AND BEHAVIOR

The paragraph on appearance and behavior is the usual place in which the patient is described as a complete entity and identified as an individual It should convey a word picture which 20 years from the date of writing will create an impression of the patient that is accurate and comprehensive In addition to his physical appearance the behavior of the patient during the interview and examination the way in which he tell his story and the relationship he forms with the physician as well as the physician s feelings toward the patient should be observed and appropriately described It is a thumbnail sketch of the general physical and behavioral characteristics of the patient as a person The following areas should be considered

1 Mental State

State of consciousness orientation mood attitude attention and memory

2 Language

Quality of speech content and coherence

3 Posture

Position in bed gait dress and appearance

4 Physique

Constitution race sex (use the terms man and woman not male and female) biologic compared to chronological age state of hydration and nutrition muscular development obvious physical abnormalities

5 Severity and Duration of Illness

Discomfort complaints color (cyanosis pallor jaundice etc) respiratory difficulties (orthopnea hyperventilation dyspnea air hunger sighing etc) cough sputum voice blushing or blanching (degree and circumstances) restlessness passing of flatus

6 Attitude and Emotional State

Mentation intelligence (estimate level) cooperation (both overt and covert) attitude toward examiner mood degree of aggressivity or passivity dependency exhibitionism modesty sudden changes in behavior in relation to special topics or parts of the examination

THE FOLLOWING EXAMPLES ARE ILLUSTRATIVE

1 The patient is a well developed muscular fairly well nourished white man of asthenic habitus appearing about 45 He seems severely and acutely ill with flushed face and profuse perspiration He is writhing as he complains in short grunting sentences of severe chest pain There is a harsh cough productive of prune juice sputum He is oriented appears of average intelligence but has difficulty attending There is good hydration of the tissues

2 The patient is a well developed tall emaciated woman who appears older than her stated age of 20 Her face is thin and pinched without make up and the bony structure is prominent Her hair is worn in a tight braid She walks with a slow languid gait Her clothes are neat but severe She wears a fixed distant resigned smile and a martyred expression She its motionless throughout the examination except when her mother is discussed at which time she picks at her dress She seems intelligent well-oriented and

without memory impairment During the physical examination she was completely passive and evidenced only minimal modesty The examiner felt he was able to communicate only at a superficial level Initially he felt a need to help and protect the patient later there was some irritation with the lack of positive response by the patient

3 The patient is a disheveled husky youth of 18 with a faint odor of alcohol on his breath (blood sample drawn) He is perspiring profusely and the skin is cool clammy and pale There is a thready pulse and rapid shallow respiration A bone protrudes through a laceration on the left thigh The patient is alert and feels certain he did not lose consciousness

APPENDIX C

Summary, Diagnoses, and Management Plans

SUMMARY OF POSITIVE FINDINGS AND FORMULATION

This should consist of 1 or more brief paragraphs in which significant positive findings are discussed These will be based on the interview physical examination and preliminary lab oratory studies They are obviously subject to amplification modification and change as a result of further observation and special examinations It is important however to come to a definite formulation and tentative diagnoses at the end of the initial work up To do so increases the diagnostic skill of the physician makes for more intelligent use of further diagnostic procedures and generally means that the initial management of the patient is more successful than without such summariza tion The basic problems may be discussed under the following headings

1 Physiologic and Anatomic Considerations

The significant positive findings which suggest a disturbance at one of these levels should be summarized and their re lation to various disease entities syndromes or pathologic processes indicated

2 Psychologic and Characterologic Formulation

The positive findings suggesting psychologic disturbances should be summarized This should be done in greater de tail if there is reason to believe that the major decompensa tion is at the psychologic level With all patients however it is important to have some consideration of their degree

of maturity and the major character traits and ego defense mechanisms This section may be developed under the following headings

A GENETIC FORMULATION The developmental factors which led to the present character structure may be discussed here In the case of psychologic illness it usually will be possible to understand the present difficulties *in the light of problems in early development*

B DYNAMIC FORMULATION This is a discussion of the problems and conflicts operating in the patient s life and a consideration of the situation which has made previous defenses inadequate

C TRANSFERENCE Describe the manner in which the patient relates to the physician Indicate what previously learned emotional attitudes the patient is using and the person or persons in the patient s background the physician now represents

3 Social and Environmental Formulation

This section should summarize briefly the familial and social milieu as well as the physical or climatic environment from which the patient comes and to which he must return after treatment

4 Accessory Factors Likely to Promote or Interfere with Recovery

Indicate any accessory physiologic constitutional pharmacologic psychologic familial, economic social and other factors which may influence the course of the patient s illness and modify his prognosis

WORKING DIAGNOSES

List the most important *primary* differential diagnoses relevant to the *present admission* in the order of likelihood and preferably separately give the diagnoses of possible secondary importance

PLAN OF INVESTIGATION AND TREATMENT

1 A plan for the further evaluation of the patient s problems and for establishing the diagnoses should be outlined in detail *List the investigative procedures in the order of* decreasing relative importance for this patient Attempt briefly to give the reason or justification for any procedures which would not be considered routine

2 A plan for the *initial management* of the patient should be outlined This should include such things as the behavioral attitude on the part of the staff as well as the degree of activity the type of initial medication and other therapeutic measures

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WORKING DIAGNOSES

List the most important *primary* differential diagnoses relevant to the *present admission* in the order of likelihood and preferably separately give the diagnoses of possible secondary importance

1 Who Prepares the Patient s Food?

Does he eat at home in a boarding house or in a restaurant? Often the wife or mother who prepares the food for the patient is the best source of dietary information

2 Economic and Social Factors

Can the patient afford an adequate diet? Can he afford it part of the time? Can he purchase foods needed for a special diet? Are home grown foods available? Does the home afford refrigeration stove and other equipment for the preparation of food? Does the patient know what kind of food to purchase?

3 The Patient s Health

Is the patient s choice of foods modified by such physical factors as inability to masticate due to faulty teeth abdominal distress after eating nausea or vomiting? Has the patient been following a restricted diet for health reasons? If so this should be specified in detail Has it helped him? Is the patient an alcoholic? Does another member of the family have a special diet?

4 Psychologic Factors

Food and affection are closely associated in the experience of the nursing infant and frequently are symbolically equated throughout people s lives Whenever severe prejudices peculiar appetites or inadequate or excessive food intake is encountered emotional influences should be considered What were the parental attitudes toward food and eating? What foods does he never eat and why? Does the patient eat non food items such as laundry starch clay block milk of magnesia etc ?

5 Religious and Cultural Dietary Restrictions

When these are found to influence the dietary habits of the patient adversely they should be discussed in detail

APPENDIX D

Specialized Areas of History-Taking and Examination

APPENDIX D 1

Nutritional History Taking

INTRODUCTION

A complete nutritional history frequently contributes important information about the patient s health problems There are 2 important goals

1 To evaluate the adequacy of the diet and to discover whether malnutrition is contributing to the patient s illness
2 To discover influences which determine the food intake of the patient such as those arising from social economic psychologic racial religious and other factors

The following outline suggests a useful approach to dietary problems and should assist the physician in obtaining a nutritional history It should be emphasized however that the approach must be modified for the individual patient in order to arrive at a satisfactory diagnosis and to establish successful treatment

GENERAL FACTORS INFLUENCING DIET AND NUTRITION

Information of importance for the nutritional history will have been included in certain sections of the medical history especially in those parts dealing with the gastro intestinal metabolic and endocrine functions but certain other areas should be discussed

K BUTTER OR MARGARINE

L OTHER FATS This grouping may include bacon grease drippings lard fat back salt pork (used as seasoning for vegetables) salad dressing etc

M BEVERAGES These include tea coffee soft drinks alcoholic beverages artificially fruit flavored drinks such as Kool Ade etc

N SUGAR SWEETS DESSERTS

SUMMARY

The important findings about the diet and the general factors influencing it should be summarized and the relation of the nutritional history to the patient s disease should be indicated

APPENDIX D 2

Developmental Appraisal of Infants and Young Children

INTRODUCTION

The maturational development of the child follows an orderly predictable pattern within which there is as in all biologic measurements great variability The performance of the individual child may vary from the average to an extent which is not necessarily related to his intelligence as ultimately measured by standard psychologic tests designed for older persons Likewise his performance in one test area may be relatively advanced or retarded in relation to another Published observations of normal development while recognizing these variations have nonetheless emphasized the average rather than the range of performance The resulting mass of norms of performance in many areas at many specific ages obscures however unintentionally the dynamic continuity of development

DIETARY INTAKE

The customary dietary intake may be obtained by first considering the usual meal pattern and then asking specific questions about the intake of individual foods

1 Customary Meal Pattern

A simple form can be used for recording the customary meal pattern the place where food is consumed and the time may be noted under each heading
BREAKFAST NOON EVENING MEAL BETWEEN MEALS

2 Food List

The patient is questioned about the usual intake of individual foods i e the number of servings per day or per week In the event that some food is consumed in very small (or very large) quantities a note may be made of the reason e g too expensive causes indigestion just don t like it etc

A MILK AND MILK PRODUCTS These may include sweet milk, buttermilk clabbered milk dry skim milk cheeses ice creams
B EGGS
C LEAN MEAT FISH POULTRY
D DRIED BEANS AND PEAS
E DARK GREEN LEAFY AND YELLOW VEGETABLES This grouping includes greens such as collards turnip salad beet greens etc broccoli green peppers carrots winter squash sweet potatoes pumpkins and tomatoes
F OTHER VEGETABLES (specify) Which vegetables in E and F are eaten raw?
G MELONS CITRUS FRUITS (oranges or grapefruit and their juices)
H OTHER FRUITS (specify)
I BREADS This may be store bread or homemade bread such as biscuits cornbread etc
J OTHER CEREAL FOODS In addition to breakfast cereals this grouping includes rice noodles spaghetti and other flour products

3 *Bowl*—unbreakable mixing bowl 6 to 9 in in diameter
4 *Bottle*—wide mouthed transparent unbreakable bottle of 3 to 4 oz capacity (e g 4 oz Evenflo nurser)
5 *Picture Book*—a small hard covered children s book with paper pages containing pictures of familiar objects and animals
6 *Common Objects*—readily available objects such as key pencil comb pocketbook coin shoe knife ball book, bell
7 *Ball*—soft rubber ball not over 2½ in in diameter

Most of the test objects may be kept together in the bowl as a readily available kit

GLOSSARY OF CERTAIN TERMS

1 *Measuring Tape* suspended over baby—The partially un coiled tape is used as a dangling object
2 *Pull to Sitting*—The supine infant is pulled by his hands to a sitting position while the examiner notes to what extent the infant supports his head The examiner must frequently keep his own head low and toward the infant s feet lest backward flexion of the infant s neck permitting him to continue to regard the examiner standing over him be in terpreted as head lag
3 *Prone Suspension*—The infant is supported prone over the table by the examiner s hand under his chest and abdomen
4 *Individual Blocks*—Three blocks are offered to the infant, 1 at a time
5 *Massed Blocks*—The whole group of blocks is offered at once
6 *Imitate Copy*—While the child is watching the examiner draws a figure for him to *imitate* forms to be *copied* are drawn by the examiner in such a way that the child cannot observe how they are done

Familiarity with this voluminous material requires an effort in rote memory which dismays all but the expert

In the tabulations at the end of this appendix prepared from published observations of normal development chiefly those of Gesell and his colleagues the attempt is made to simplify the developmental appraisal by dividing the span from birth to 5 years into 8 arbitrary age periods of increasing length The salient features of normal development in each period are stated in a few words at the head of the corresponding table For the most part each outline calls for observation of posture activity and manipulation of test objects without attempting to define performance in psychologic terms Each table summarizes the maturation of average performance of normal infants and children during the stated age period Landmarks of performance characteristic of intermediate ages within a period are with few exceptions not indicated The necessary observations and tests are simple they are presented according to a plan designed for incorporation into the physical *examination* It must be continually borne in mind that the tables describe *average* progression of normal performance and that considerable deviation may be normal

Through the use of this material the physician can formulate an impression as to whether or not an infant or child is performing appropriately for his age period The diagnosis of developmental retardation should always be made with great caution ordinarily either after documentation of continued poor progress in the course of repeated examinations over a period of time or by the expert in developmental appraisal Adverse circumstances such as unfavorable emotional environment or crippling physical illness may inhibit performance of which the child is genetically capable

TEST OBJECTS

The required test objects most of which are already present in the waiting or examining rooms of physicians who treat children are listed for each age period A few objects require the following further specification

1 *Pill*—large bright colored pill such as a vitamin sample
2 *Blocks*—plain or figured cubic wooden blocks not larger than 1¼ in on an edge

3 *Bowl*—unbreakable mixing bowl 6 to 9 in in diameter
4 *Bottle*—wide mouthed transparent unbreakable bottle of 3 to 4 oz capacity (e g 4 oz Evenflo nurser)
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Full Term Birth to 2 Months

Asymmetry of Posture Emergence of Social Awareness

Measuring tape or t those pe
Flashl ght
T ngu d p essor
B ll

Supine

S c l r spo s e ss Bri f g t re→Impass e ga d→Al t m l aw e ss ol e m r
F ll ws p rson w th yes

P t d t ty
B dy Asymm trical w th t c n k r fl x Mo o espo se
R lls partly t de→L es flat o ba k
H d Turn d t s d m v th ough 90
H ds F t d
Tiss e tu g Scrawny→Firm

Test objects

M as g tape o stethosc p u pe d d o b by
B f pe c pt n d rect l of vis on→D l y d pe c pt on just out de l e of
F ll ws with y 90 m re t m dl e→Follows 90° past m dl e
Flashl ght D es n t foll w t w th y s
T gu depress pl ced h d
Fist l s tightly c ta t (does t cc pt t)→Rec i es t r ad ly
D ps t t o c→R i t bri fly
B ll P g ss e wa es l wn by cha g f ct ty d f c l resp nes

Pull to Sitting

H ad T tal l g→Mod rat l g

Supported Sitting

P t
B k R und d
He d Droop ng m m t rily rais d→Unste dily e ect

Supported Standing

P t e L gs bri fly t d d toe fl x d

Prone Suspension

P t D oop g→E t ded w th h ad a d l xt em t in lin w th body

Prone

P t d t ty
B dy Th ghs fl d C wl g m m ts of low r t m t s
He d Tu t t d l fts t b ly ff t bl t p→l fts t 2 t 3

2 to 4 Months

Development of B lateral Symmetry Beginnings of Eye Hand Coordination

M a g tap t tl sc p
Flashl ght
T g d pre r
B ll
Pill

Supine	*S al p* Pl t re →Actı e play ı th m r M ı t ted m th t t bj ts
	F t d t ty *B dy* A ymm t cal, w tl t k fl →P d m tly ymm t l t bly t ty f rms *H d* T d t d →H ld p d m tly m dp t *H ds* P d m tly fi t d→Pred m tly p F g pl k rat h I t f th m→S d pl y th th m
Test objects	*M as g t p* t th p u.p d d b by I as gly p mpt p rc pt ut de d t l f ıs Sl ly f ll ws 90 th y →R d ly f ll vs 180 D l yed fi t f ga →Al t tı t →H t-o m ss m dlı e b m l c t ct *Flashl ght* D t f ll t w th y s→F llows ıt *T g d p* pl c d h d R ta t f as gly p l g d p ods→P ts t ı m uth I f t↔R g d t brı fly↔R g rds t mm dı t ly d t tly→App l t w th f h d *B ll* Al rt f cıal p s s
Pull to Sitting	*H d* M d t l g→Sl ght l g
Supported Sitting	*P t* *B k* U formly u d d→Upp b k tra ght *H d* U te dy→St dy h ld f d
Supported Standing	*P t d t vity* Sustaı g fra tı f w gl t l fly E t ds l gs cu tly fl t →R s to t m y l ft f t
Prone	*P t d t ty* *B dy* R s sh uld rs→S pp ts lf lb w d f rms→M y ll t up e (hist ry o ob rvatı) Thıghs fl d→Legs t d d *H d* R es t ecurrently 2 3 →holds t ta dly p rp d ul t t bl t p
Test objects	*B ll* t th p (large bj t) I d ff t w →Al t t t d actıvat *Pill* (m ll bj t) U re →D l y d reg l b f w s

Good Head Posture Emergence of Independent Use of Each Hand

M asu ng tape or stethoscop
To gue d pre s r
Bell
Block
I ll

SUPINE	*S al e p su s* B ware f st ng m (hist ry or ob ervati n) usu lly djusts re d ly *l t d t ty* M ta b l t ral ymm try→R a d e t nd l w xt m u s→Pl y w th f t l ont t b k→D l k s ly g n ba k→R ll to pro e (hist ry or obs rvat n)
Test objects	*M as g tape o* t thoscope u pe d d o r b by H t m bum n l t t→Two-h nd re h→O e hand h *T g d p s* L k→G asp t ct→Gra ps on se g→Transf rs t oth r ha d *B ll* M n lest n m t d wa es f sou d→Turns h d to prop r s de
PULL TO SITTING	*H d* Sl ght l g→N l g Ass ts x m r→R u s h ad po tan ously
SUPPORTED SITTING	*P t* *B k* K *p upp* b k tra gl t→B l ll th uppo t→Supports self briefly on ha ds *H ad* St dy h ld f rw d→H ld r ct
Test objects	*Bell* Sh w renes f so d→R ct f r a d h lds bell→B ngs t o tabl *I d d al bl k* Looks at l→H lds f l ks t c nd→Grasp l h ld 2 br fly not s th d Precari us gra p t t→P lm r (4 f g r) gra p→R d l p lm r (3-fing) g a p *Mas d bl ks* Look →G a p l n conta t→G a ps d h lds l g asp l o e ral oth rs *D pp d obj t (b ll bl k) I n* re of loss→Foll ws obj ct w th eye →R cu s t
SUPPORTED STANDING	*P st d t ty* S ppo ts n ll f ct n f w ght→S pp rts most f w ght bounces
PRONE	*P t* R t lb w→O lbow a d l h d→B th ha ds nd abd me →Pos bly ha ds and kn es
Test object	*P ll l c* tly aw re f t→R k s t ward it w th wh le h d m y t u h it

6 TO 9 MONTHS
Emergence of Index Finger Poking and Pincer Grasp
Sits and Creeps

B ll
Bl k
B wl
P ll

HISTORY AND OBSERVATION

S l p C t d w f t g rs freq tly m f t d g tt pt d d

S tt g N d pp t→S ts w ll→Cl g f m tt g t p p sit

S pp t d t d g N d tru k pp t d→N d ly t h h d h ld→P lls lf to t d g

P T t p t bd →F t→C ps

TESTS WHILE SITTING (Mother s lap)

B ll B gs t t bl →W t

I d d l bl k
R d al p lm (3 fi g) gra p→R d l d g tal (fi g r) gra p
Gra p l h ld 2 l ks t th d→
Gra p ll 3→
C mb pl y→
H ld 2 d l t tl d

M d ll k P ks up 2 3→R l v lu t ly→E pl ts l

Bl ks d b l H ld blocks look t b wl→T h block t b l→F g rs bl k pl ed bowl

Bl k d pll (l g d ll bj t)
P d m t t re t bl k→P d t te est ı p ll

P ll Wh l h d k g→
Rad l rak g→
I d fi g pp h→
S ss rs g asp (th mb d d f d v fi g) w th rv d l r fi g rs→
S sors gr p w th t d d fi g rs→
P r gra p (th mb d t p f d r m ddl f g) w th ha d t g t ll

9 TO 15 MONTHS

Increasingly Deft Release of Objects Walks

Block
B wl
P ll
Bottl

B ll
Pen l and p per
P ctu e book
C mm n obj ts

HISTORY AND OBSERVATION

S al p Ind at w nts by g tu a d w rds I as g te e t i p opl
S tt g S ts w th ut turn g→P ts (11 m nths)

TESTS WHILE SITTING (Mother s lap)

I d d l ll ks Grasp all push s l w th n th →
R leases l whil h ldi g a th r→
Att mpts t w r w th ut s cce s→
Bu ld tow r of 2 when sh wn

M s d bl cks Pl ys with 3 r m e→
S e 2 mult u ly l with h h d→
Pl y w th ral q t lly (11 m th)→
P k p 2 n l h d

Bl ks a d b wl Touches bl ck in bowl w th h nd→
R moves block→
Puts l i w thout rel a g→
R l as s l o d m trat n→
R l as l spont e ly→
P ts up t 6 i t b l d r m s th m

P ll P r grasp w th h nd st g t ble→P r gra p f om b (11 m ths)

P ll a d b ttl Sh ws i crea g p f re fo p ll (mall bj ct) o r b ttl (l g obj ct)→
Po ts at p ll bottl →
Tries t relea e p ll t bottle→
R leases su c ssf lly whe h wn→
R l as p t u ly o mm d

Ball bl k th t y Off rs t xam r w th ut r l as g→
R l as mma d→
Off rs h ws t p nt ously→
Att mpts t throw n pl y or p rv rs ness

P d p p (ft r l y) *Im t te* sc bl le→Att mpts to *m t t* rt cal t k

I t b k (ft r l y) P ts p ctures→H lps turn p ges

C mm bj ts (aft l ye) I d cat recogn ti n of l or m re

Execution of Complex Orders Crude *Imitation* with Pencil and Paper

Bl k B wl P ll B ttle	P cil a d p p I t re bo k C mmo obj ts B ll St rw y

HISTORY AND OBSERVATION	*S l p ns* B t l t f t g *H y d t ty* Squats t pl y D m t mm ry P ll l th tl coop t ve pl y P ll t ys ro d (lt 18 m th) *U f u ds* Comb es 3 m w ds t t
TESTS WHILE SITTING	*Bl k* B lds t f 2 whe h →B ld t w f 6 or 7 wh sh wn q t d B ld t f 2 m e *Bl ks d b ul* P ts 5 6 blocks to bowl d mo th m→ F lls b wl→ H ds filled bowl t m *I dl d b ttl* R l as p ll t bottle po t ously on mm d→D mp t t (18 m tl s) *P l d p p* *Im t t s* sc bbl→ S bbl po t ly→ *Im t t s* t gl t l w th t d c m t n f d rect → *Im t t s* t cal l d rcl *P t b k* H lp t m p g s→T s 2 3 p g s t t m →T s p g s gly P ts p ct re →R gn (m po ts t) 5 m e p t res *C m n bj ts R g s* al→*N mes* 2
TESTS WHILE UP AND ABOUT	*Ball* Att mpts to th w pl y→Throws o mm d→K ks whe shown→K cks on mma d *St s* Cre p p→ W lks p w th h d h ld→ W lks p h ld g b t d w w th h d l ld→ W lks up d d w l (m y h ld ba te) both f t t e h tre d *I b l mp k* (g b ll oth bj ct) Ca n t 2 mpl d re t →C rr o t 4 comma ds

9 TO 15 MONTHS

Increasingly Deft Release of Objects Walks

Blo k
B wl
P ll
B ttle

B ll
P ncil a d p per
P ctu e bo k
C mmo objects

HISTORY AND OBSERVATION

S l e p
S tt g S ts w th t turn ng→P v ts (11 m nths)
I d cate w nts by g tu nd wo ds In r a g i t r t p pl

TESTS WHILE SITTING (Mother s lap)

I d d I bl k Grasps ll pushes 1 with th →
Rel a es 1 whil hold g th r→
Att mpts t w w th ut s cc ss→
Bu ld to r of 2 when sh wn

M s d bl ks Pl ys w th 3 r m e→
S es 2 m lt usly 1 w th h h d→
Pl ys th ral q ent lly (11 montl)→
P k up 2 n t h d

Bl ks d b ul Touches bl k n b wl w th h nd→
R mo s bl k→
P ts 1 w th ut r lea g→
R l a l n d m trat →
Rel 1 p t n ously→
Puts up to 6 nt bowl d m th m

Pll P r grasp w th h nd est g n t ble→P r gra p from bo (11 m ths)
P ll a d b ttl Sh ws n r g p l re c f p ll (mall obj ct) r bottl (l g obj t)→
P ts t p ll b ttl →
T t rel ase p ll t b ttle→
R l ss lly whe sh w →
Rel s p t ly omm d

Ball bl k th t y Off rs t m r w th ut l as g→
R l s o mm d→
Off rs o b ws t pontan ously→
Att mpts to throw i pl y or p rv rseness

P l d pap (ft l r) Im e t s bble→Att mpt to m tat e beal t oke
I t e b k (ft l y) P ts p tu →H lp turn pages
C mm bj t (ft r l ye) I d t recogn t n l l or more

3 to 5 Years

Increasing Competence in Drawing Achievement of Good Balance on One Foot

Bl ks
P cil d p p r
St w y

	3 Yr	3½ Yr	4 Yr	5 Yr
History and Observation	P rall l pl y	C p rat (associ t) pl y	U s ss rs t t t p tures	
Tests				
Bridge of 3 blocks	B lds wh sh	B ld f m mod l		
Drawing of geometric forms	*Im t t* c ss *C p* l	*C p* ss	*Im t t* sq	*C p es* squa C t draw t gl d mo d (w ll b bl t 6 y rs)
Spontaneous drawing of man			Crud h d a d ppendag s	Heads torso rm l gs
Use of words	R p t 3 d g ts		R p ts 4 d g ts	N m 4 l rs
Stairs	W lk up lt t g f t Walks d w b th f t t h t d			W lks d wn lt ti g f et
Additional tests of coordination and balance	B l *l f t* m m t ly		Sk p l f t	Sk ps o both f t B l s l d n l foot

2 to 3 Years

Descriptive Use of Language Achievement of Good Coordination and Balance

Blocks
I c l and s yer
l t book
Comm n obje t
B ll
St rw y

History and Observation

Play d a t mly
Puts on hoes U butto s cloth s
I call l pl y→Will gn ss to t k tu ns
P lls t ys→Pu h s nd t rs Rid t ycl

Tests While Sitting

Bl k
B ld tow f 6 r 7→B ld tow f 9 o 10
Builds tra f 2 m ←Add ch m y →B ld b dg of 3 wh n sh wn

P d pap
H lds p c l by fi t→H lds t by fi gers (30 m tl)
Im t t t i l n d circle→
Im t t s both t l nd h ont l tr k →
Im i t ros p re)

P t b k R g 5 p ctu e →*N m* 8 nd d sc bes rt on

C mm bje t N mes 2→N *me* 5 *n* e d d at s tl u e

F ilt *f u d* (3 y rs)
An rs re tly l q t n as t a t sty wh n hu gry l epy c ld (
R p t 3 d g t

Tests While Up and About

St W lk p a d d w l e (n ay l ld b *t*) b th f et to a h t d→
W lk p lt rt t g f t

Add t l t ts f d t d b f
J mp pl w tl b th f t→J mp d wn from stool or botto n st r th both f t
K ks b ll→W lk t pt wh l wn→Bal nce m m nta ly n l f t

l b l mp h (g b ll o th r bj t)
Ca out 4 pl d ct s→Und rst ds t le t 2 p p t s

CRANIAL NERVES

I Olfactory

A. SUBJECTIVE Impairment of sense of smell olfactory hallucinations uncinate attacks
B OBJECTIVE Test each nostril naming odors used

II Optic

A. SUBJECTIVE Failing vision field defects
B OBJECTIVE
1) *Visual acuity*—examined by Snellen test types
2) *Fields of vision*—perimetry is indicated in all suspected cases of intracranial or pituitary tumor or when rough tests have suggested defects
3) *Fundi*—ophthalmoscopic examination

III IV VI Oculomotor Trochlear Abducens

A SUBJECTIVE Double vision
B OBJECTIVE
1) *Pupils*—size equality regularity reaction on convergence and to light directly and consensually
2) *Ocular movements*—both in response to command and on following a moving object note weakness of extraocular muscles describe strabismus and nystagmus
3) *Eyelids*—ptosis weakness compare palpebral fissures

V Trigeminal

A MOTOR DIVISION
1) *Subjective*—stiffness or weakness of muscles of mastication
2) *Objective*—test masseter temporal and pterygoid muscles

B SENSORY DIVISION
1) *Subjective*—pain paresthesia or numbness of the face

APPENDIX D 3

Neurologic Examination

The following outline is to be employed in examining patients in whom a disturbance of the nervous system is suspected It is assumed that a complete medical history and a physical examination of the patient have been recorded

HISTORY

1 Inquire specifically about the following symptoms related to the nervous system headache vomiting dizziness disturbances of consciousness disorders of cerebration and of speech motor disturbances disorders of gait Describe in detail convulsive attacks or other involuntary movements pains or paresthesias and sphincter disturbances
2 Inquire carefully regarding injury to the head or spine
3 Note exposure to alcohol heavy metals or other poisons
4 Record relevant hereditary data

CEREBRATION

Survey the mental status noting attention concentration orientation memory emotional state intelligence hallucinations delusions obsessions change in habits disposition

PERFORMANCE OF SKILLED ACTS

Record whether right or left handed

1 Speech

Note spontaneous speech answers to questions performance of test phrases In the presence of dysphasia a complete psychomotor study is indicated

2 Handwriting

Specimen.

3 Practical Response on Command

Test for apraxia

CRANIAL NERVES

I Olfactory

A SUBJECTIVE Impairment of sense of smell olfactory hallucinations uncinate attacks

B OBJECTIVE Test each nostril naming odors used

II Optic

A SUBJECTIVE Failing vision field defects

B OBJECTIVE

1) *Visual acuity*—examined by Snellen test types
2) *Fields of vision*—perimetry is indicated in all suspected cases of intracranial or pituitary tumor or when rough tests have suggested defects
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III IV VI Oculomotor Trochlear Abducens

A SUBJECTIVE Double vision

B OBJECTIVE

1) *Pupils*—size equality regularity reaction on convergence and to light directly and consensually
2) *Ocular movements*—both in response to command and on following a moving object note weakness of extraocular muscles describe strabismus and nystagmus
3) *Eyelids*—ptosis weakness compare palpebral fissures

V Trigeminal

A MOTOR DIVISION

1) *Subjective*—stiffness or weakness of muscles of mastication
2) *Objective*—test masseter temporal and pterygoid muscles

B SENSORY DIVISION

1) *Subjective*—pain paresthesia or numbness of the face

2) *Objective*—test sensation for each of the 3 divisions

C Corneal reflex Right left

VII Facial

A Motor division

1) *Subjective*—stiffness or weakness of facial musculature

2) *Objective*—note asymmetry of the face at rest on volition and on emotion describe part involved noting whether weakness is of central or peripheral type

B Sensory division

1) *Subjective*—impairment of sense of taste

2) *Objective*—examine taste on anterior two thirds of the tongue in all peripheral facial lesions (chorda tympani)

VIII Acoustic

A Auditory division

1) *Subjective*—tinnitus impairment of hearing

2) *Objective*—(*a*) Note distance for hearing watch and whisper—right left, (*b*) Test air conduction further by tuning fork C128 and C2048 (*c*) Test bone conduction with C128 comparing 2 sides (*d*) Compare bone conduction and air conduction on each side (Rinne) (*e*) With tuning fork in midline test for lateralization (Weber)

B Vestibular division

1) *Subjective*—vertigo vomiting

2) *Objective*—in patients with vertigo or nerve type of deafness special tests of vestibular function are indicated (Bárány)

IX X Glossopharyngeal Vagus

A Subjective Difficulty in swallowing change in voice pain

B Objective Note movement of the palate on phonation and of the larynx on deglutition laryngoscopic

examination is indicated in disturbances of phonation Pharyngeal and palatal reflexes—right left Slowing of pulse

XI Accessory

Test strength of sternocleidomastoid and trapezius muscles

XII Hypoglossal

A Subjective Disturbance of articulation
B Objective Note deviation of tongue on protrusion and strength of lateral movements atrophy and fibrillation

VOLUNTARY MOTOR SYSTEM

1 Attitude and Posture

Note natural position assumed in the recumbent sitting and standing posture—head trunk and limbs Note especially retraction of the neck Kernig s sign Describe deformities contraction or limitation of free range of movement at the joints

2 Gait

Describe with eyes open and closed walking forward sidewise backward on a line in a circle

3 Muscle Status

A Tonus Type and distribution
B Atrophy or hypertrophy Groups or individual muscles involved

4 Muscle Strength

A Upper limbs Movements of the limbs and fingers power of the grip movements at the wrist joint pronation and supination of the forearm movements at the elbow joint and movements at the shoulder joint

B THE TRUNK Movements of the head and spine abdominal muscles diaphragm intercostal muscles

C LOWER LIMBS Movements of the toes movements at the ankle joint knee joint and hip joint

In lesions of the lower motor neurone type record the power of the individual muscles in outline form Electrical reactions are also indicated

5 Coordination

A EQUILIBRIUM Eyes open and closed. (*a*) Arms out stretched patient in sitting posture (*b*) Balancing on 1 foot (*c*) Standing with feet together (Romberg)

B SPECIAL TESTS Eyes open eyes closed right, left. (*a*) Finger to nose (*b*) Pointing and past pointing (*c*) Heel to knee to toe and to object above—patient recumbent. (*d*) Rapidly alternating movements—both upper and lower limits Diadochokinesia

C PERFORMANCE OF NATURAL ACTS

6 Involuntary Movements

Note tremors twitchings choreiform or athetoid movements tonic or clonic spasms tics Describe effect of rest volition emotion, or other factors

GENERAL SENSORY SYSTEM

1 Cutaneous Sensation

A TOUCH Wisp of cotton

B PAIN Pinprick

C TEMPERATURE Test tubes containing hot and cold water

2 Deep Sensation

A MUSCLE TENDON AND JOINT SENSE Posture and passive movement

B PAIN Deep pressure note tenderness on pressure over nerve trunks

C VIBRATORY Tuning fork

3 Combined or Discriminatory Forms

A Tactile localization Topognosis
B Tactile discrimination 2 point.
C Appreciation of form and texture Stereognosis

REFLEXES

	Right	Left

1 Deep *

Jaw (pons)
Biceps (C 5 6)
Radial (C 5 6)
Triceps (C 7 8)
Knee jerk (L 3 4)
Ankle jerk (S 1 2)

2 Superficial

Upper abdominal (T 8 10)
Lower abdominal (T 10 12)
Cremasterics (L 1 2)
Plantar† (L 1 S 2)

3 Visceral Reflexes

Vesical sphincter ✓
Rectal sphincter

SKELETAL SYSTEM

1 Skull

Describe any abnormality in size or shape Note tenderness on palpation or change in percussion note (Macewen) Auscultate for bruit

Record as f llows —0 bs t +sl ggish ++acti +++hyperacti ++++cl us
†Represe t dir ct n f b g toe by rrow g ↑ indicates B b nski phe- n m n.

2 Spine

Note deformity limitation of movement tenderness of spinous processes

3 Soft Tissues

Abnormal vascularity scars tumors

AUTONOMIC NERVOUS SYSTEM

1 Cervical Sympathetic

Note dilation of pupil to shade enophthalmos or exophthalmos ciliospinal reflex

2 Disorders of the Thoracic and Abdominal Portions of the Sympathetic

3 Angioneuroses

4 Abnormalities of Sweating

5 Trophic Disorders

6 Peripheral Vascular

Blushing temperature of skin after prolonged exposure comparison of 2 sides

ENDOCRINE SYSTEM

Note any disorders of function

CEREBRAL LOCALIZATION

In those cases in which the neurologic examination has suggested the possibility of an intracranial tumor the following schema should be used in localizing the lesion

1 Frontal

Various combinations of the following

A PREFRONTAL Alteration of character and temperament failure of memory intellectual dullness euphoria and

facetiousness defect in attention neglect of sphincters contralateral grasping and groping reflexes

B POSTFRONTAL OR PRECENTRAL Contralateral motor phenomena either irritative (convulsive) or paralytic disturbances of conjugate ocular deviation to opposite side motor dysphasia (depending on handedness) contralateral ataxia

C SUBFRONTAL Ipsilateral anosmia exophthalmos optic atrophy central scotoma defects in visual fields

2 Temporal

Uncinate fits—hallucinations of taste and smell dreamy states sensory dysphasia—word deafness and various other types (depending on handedness) contralateral upper quadrantic defects of the visual fields contralateral hallucinations of light or form mild contralateral hemiparesis especially of the face

3 Parietal

A POSTCENTRAL AND PARACENTRAL Generalized or Jacksonian convulsive seizures preceded by contralateral sensory aura contralateral sensory disorder of cortical type impairment of joint sensation point discrimination point localization and stereognosis

B PARIETO-OCCIPITAL REGION (supramarginal and angular gyri) Contralateral lower quadrantic defects of the visual fields visual inattention visual agnosia—word blindness defect in perception of depth and distance (depending on handedness) disturbance of optic nerve nystagmus

4 Occipital

Contralateral homonymous hemianopic defects complete or incomplete depending on location and extent simple visual hallucinations

5 Cerebellum

Ataxia vertigo reeling gait (uninfluenced by closure of the eyes) asynergia dysmetria adiadochokinesia (inability to

perform rapidly alternating movements) nystagmus hypotonia, pendulation of knee jerks rebound phenomenon

A VERMIS Tendency to fall forward or backward no unilateral preponderance of incoordination

B LATERAL LOBE Tendency to fall sideways (usually toward side of lesion) preponderance of incoordination in ipsilateral limbs predominance of nystagmus on ocular deviation toward side of lesion

C CEREBELLOPONTINE ANGLE Tinnitus attacks of vertigo progressive nerve deafness and absent vestibular reactions on the side of the lesion variable ipsilateral cerebellar signs and involvement of cranial nerves V VI and VIII rare involvement of IX and X hemiplegic symptoms

6 Pituitary

A NEIGHBORHOOD SYMPTOMS Bitemporal hemianopic visual defect often beginning as a paracentral scotoma or as a notch at the periphery of the upper quadrants primary optic atrophy (optic chiasm) ocular palsies paresthesia in domain of ophthalmic nerve (sphenoidal fissure) proptosis edema of conjunctivae and eyelids (cavernous sinus) somnolence polyuria and polydipsia (tuber cinereum) uncinate fits (temporal lobe) mental dulness anosmia (frontal lobe)

B GLANDULAR SYMPTOMS Acromegaly alteration of basal metabolic rate and glucose tolerance adiposity abnormalities of skin and hair deviation of sexual development and function and secondary sexual characteristics

PSYCHOMOTOR FUNCTIONS

1 Spontaneous Speech

(1) Choice of words—extent of vocabulary
(2) Pronunciation
(3) Tendency to misplace or omit words or syllables
(4) Tendency to repetition echolalia, paraphasia jargon
(5) Tendency to preservation of automatic mechanisms

2 Auditory Perception

(1) Answers to spoken questions
(2) Understanding of inarticulate sounds
(3) Appreciation of music
(4) Repetition of words phrases sentences

3 Visual Perception

(1) Reading
(2) Answers to written questions
(3) Understanding of pictures
(4) Appreciation of time (watch)

4 Tactile Perception

Appreciation of form and texture—stereognosis

5 Writing (use of nonparalyzed hand)

(1) Spontaneous—name address time
(2) Writing to dictation
(3) Copying—letter words sentences
(4) Drawing—square tree dog
(5) Tendency to mirror writing

6 Intellectual Components of Speech

(1) Ability to correlate word memories
(2) Synonyms and definitions

7 Practical Response

(1) Mimicry—gestures and pantomimic movements
(2) Practical responses to spoken commands
(3) Practical responses to written commands
(4) Appreciation of identities and uses of objects

SUMMARY

1 Positive Findings

(1) Subjective
(2) Objective

DIAGNOSIS

State impression in terms of
1 Etiologic factor or nature of lesion
2 Localization of lesion or anatomic damage
3 Functional disorder or syndrome

APPENDIX D-4

Orthopedic Examination

INTRODUCTION

The orthopedic examination is concerned chiefly with the musculoskeletal system Such an examination is only a supplement to the careful and complete general history and physical examination The orthopedic examination is concerned with *deformity joint mobility* and *muscle changes*, such as wasting or hypertrophy

1 Deformity

This may be *angular* as in malunion of a fracture severe bowing due to rickets or scoliosis Deformity may manifest itself as *shortening* of an extremity due to dislocation malunion of a fracture or epiphysial growth disturbance Deformity may be *rotational* as in tibial torsion or anteversion of the femoral neck Deformity may present itself as a *mass* or enlargement due to overgrowth of bone or soft tissue as in tumors

2 Joint Mobility

Limitation of joint motion is an important physical sign and its cause must be determined The difference between active and passive joint motion should be understood Should a patient lack active knee extension but the exami

ner be able to extend this knee passively an extra articular cause of the active limitation should be sought (i e paralysis of quadriceps etc) Limitation of both passive and active motion may be caused by

A MUSCLE SPASM Due to pain as in acute back strain or due to spasticity of central origin as in hemiplegia
B CONTRACTURE Of capsule ligaments and muscles controlling joint motion (any type of arthritis)
C MECHANICAL BLOCK By bone or cartilage (torn meniscus of the knee)
D BONY ANKYLOSIS Rheumatoid arthritis septic arthritis surgical fusion

HISTORY

Most of the pertinent facts are recorded in the basic outline of history and physical examination Special attention should be given to (1) the date and mechanism of onset of the patient s complaint (2) a detailed description of pain (type of pain radiation what aggravates it what relieves it) (3) the type of previous treatment and the response to treatment

EXAMINAT ON

The only instruments needed for the orthopedic portion of the examination are a measuring tape reflex hammer and a firm examining table Measurements should be taken from 1 bony landmark to another (anterior superior iliac spine to medial malleolus for leg length) Measurements of circumference should be at stated levels (i e thigh 6 in above the patella) Measurements of joint motion should be stated in a manner clear to any reader (i e the knee extends to 120 degrees and flexes to 40 degrees) Corresponding measurements of the opposite joint should be recorded

The following is a brief summary of the more important points to be noted in examination of certain areas of the body

1 The Ba k

First note the patient s gait and ability to move about to dress and to undress Note the spinal curves (lordosis

kyphosis scoliosis) Observe paravertebral muscle spasm asymmetry of flank folds tilting of the pelvis and range of motion of the spine in all directions Record at what level back motion takes place and at what level it is restricted Careful palpation of bony prominences and muscle groups should be carried out The straight leg raising test is done with the patient in the supine position by gradually elevating the leg with the knee extended A careful neurologic evaluation should be made in conjunction with the examination of the back

2 The Cervical Spine

Note the manner in which the patient holds his head Note tightness of any muscle groups particularly the sternocleidomastoid Note range of motion flexion extension lateral bending and turning in both directions On palpation identify the spinous processes of C2 and C7 Note any tenderness or mass Skeletal lesions of the cervical spine are frequently associated with nerve changes and a careful neurologic evaluation should be made

3 The Hip

Careful inspection of the patient s gait should be made The Trendelenburg test is carried out by having the patient stand on the affected leg while elevating the normal side The normal side of the pelvis will drop with a positive test Note the level of the trochanters in relation to the iliac crest Deep palpation of the hip joint both anteriorly and posteriorly may detect a mass or deformity Note the range of motion in abduction adduction flexion extension internal and external rotation Be sure the pelvis is fixed by holding the opposite hip flexed so as to record only hip motion and not lumbar spine motion Measure for leg shortening and for thigh atrophy Remember hip disease may cause knee pain

4 The Knee

Note evidence of swelling heat or tenderness Note the range of flexion and extension Test the collateral ligaments

by passive abduction and adduction of the extended knee Test the anterior cruciate ligament by drawing the tibia forward from the femur with the knee flexed (opposite test for posterior cruciate) Palpate the following patella patellar ligament suprapatellar pouch, joint line anterior medial and lateral to the patellar ligament Ballotte patella (patella click test for joint fluid) Palpate the popliteal space for mass or tenderness Measure thigh circumference

5 The Ankle and Foot

Note evidence of swelling or deformity Note range of ankle motion (flexion and extension only) Note subastragalar motion (inversion and eversion) Palpate the medial malleolus and deltoid ligament lateral malleolus and lateral ligament tarsal metatarsal and toe bones and joints Note any evidence of abnormal callus hammer toes hallux valgus equinus or calcaneus deformities varus or valgus or cavus deformities

6 The Shoulder

Inspect shoulder for general contour and note any atrophy with particular attention to deltoid and supraspinatus muscles Palpate the area around the acromion process (note tenderness particularly over subdeltoid or subacromial bursa) Palpate the coracoid process and bicipital groove the acromioclavicular and sternoclavicular joints Test the range of shoulder motion (abduction, adduction flexion extension internal and external rotation) In recording range of shoulder motion be sure to record scapulohumeral motion and distinguish it from scapulothoracic motion This may be done by holding the scapula and clavicle firmly down with 1 hand while testing passive motion of the shoulder with the other

7 The Elbow

Inspect the elbow for deformity (swelling changes in contour change in normal carrying angle) On palpation the following anatomic points may be distinguished *medial and lateral epicondyle olecranon radial head ulnar nerve*

and biceps tendon Record the range of flexion extension pronation supination Note any evidence of swelling or tenderness and relate this to the anatomic area palpated

8 The Wrist and Hand

Inspect the hand and wrist for swelling and change in color or contour Note any evidence of specific types of deformities caused by ulnar median or radial nerve injury Volkmann s contracture or rheumatoid arthritis Palpate the following anatomic points radial and ulnar styloid anatomic snuff box for the carpal navicular the individual metacarpal bones and phalanges Note the range of motion in the wrist flexion and extension radial and ulnar deviation and pronation and supination Record motions in fingers and metacarpo phalangeal joints Specific tests for nerve and tendon injuries should be done when indicated Motor power in the small hand muscles should be noted particularly abduction and adduction of the fingers and opposition of the thumb Sensory testing to pin point and light touch should be carried out

APPENDIX D 5

Emergency Examination

Gentleness and reassuring calmness are imperative in the examination of the emergency patient Where abdominal disease or injury is suspected greater injury can be avoided and the confidence and cooperation of the patient assured by cautious careful and gentle palpation and manipulation If a broken bone is suspected never try to elicit the ancient and now dishonored signs of pain and crepitation by motion *Take an x ray! If an injury to the vertebral column or the spinal cord is suspected do not ever allow the patient to sit up or even to be moved without constant upward traction on the head* This policy must not be violated until you personally are

satisfied that the x rays are negative Do not contaminate probe or instill liquids into bleeding or draining ears

1 *Is the patient breathing?* If not is the airway obstructed? Elevate the chin and aspirate the air passages to clarify this

2 *Is the patient bleeding?* If so can the hemorrhage be controlled by pressure hemostat or tourniquet?

3 *Is the patient breathing* (strongly weakly irregularly) *but cyanotic?* Is he wheezing or is there stridor? Is there retraction of the chest wall or supraclavicular areas or use of the accessory muscles of respiration? Is there deviation of the trachea or asymmetry of the chest with respiration? If so is the airway partially obstructed is the rib cage crushed is there a sucking wound into the chest or have the pleural spaces become occupied by blood or air?

4 *Can the pulse be felt?* If not or if it is weak rapid or thready is the patient in shock as demonstrated by an abnormal lowering of the blood pressure?

5 *Is the blood pressure abnormally low?* If so is this due to loss of blood externally or internally into a body cavity or into a relaxed vascular bed or is it due to heart failure?

6 *Is the patient conscious and alert?* If the sensorium is depressed or the patient is unconscious is the departure from normal due to cerebral anoxia from an expanding intracranial lesion from shock from injury to the brain from a convulsive seizure from alcohol drugs or poisons or from a metabolic disturbance such as diabetes?

7 *Does the patient have anesthesia or paralysis?* If so is this due to injury to the brain spinal cord or a peripheral nerve?

8 *Is the patient in pain?* If so where does he hurt? The localization of pain is an invaluable clue to the site of the injury

9 *Is the rectal temperature elevated?* If so is the rise due to a systemic or a localized infection or to a failure of the heat regulating mechanism or to a foreign protein reaction other than a bacterial toxin?

10 *Laboratory procedures* are adjunctive and should be employed judiciously and only in seeking answers to the foregoing questions It usually is important to record on a special graph the pulse blood pressure and respiration readings taken every 15 minutes

11 *Conclusions* If the patient is not bleeding if he has normal pulse respirations blood pressure and temp rature and if he is conscious and alert without subjective evidence of pain or objective evidence of injury he does not present an emergency and may be examined in the usual manner

N B If for any reason a poison is suspected and you are not sure of the diagnosis or treatment consult immediately your nearest Poison Control Center listed below

Poison Control Centers

ALABAMA

ANNISTON
Anniston Memorial Hospital
Tel AD 7 5421

BIRMINGHAM
University of Alabama Medical Center
Tel 53 3531

FLORENCE
Eliza Coffee Memorial Hospital
Tel AT 2 8321

ARIZONA

PHOENIX
Maricopa County Medical Society
Tel Alpine 8 8331

TUCSON
University of Arizona
Tel MA 4 8181

ARKANSAS

LITTLE ROCK
University of Arkansas Medical Center
Tel Franklin 2 4351

CALIFORNIA

BERKELEY
Herrick Memorial Hospital
Tel Thornwall 5 0130

LOS ANGELES
University of California Medical Center
Tel Bradshaw 2 8911

Children s Ho pital Society *of Los Angeles*
Tel Normandy 4 2121

MARTINEZ
Contra Costa County Hospital
Tel Martinez 3080

OAKLAND
Alameda—Contra Costa Medical Assoc
Tel Olympic 2 8171

Children s Hospital of the East Bay
Tel Olympic 2 1143

Highland—Alameda County Hospital
Tel Kellogg 2 1122

ORANGE
Orange County General Hospital
Tel Kellogg 8 2331

San Francisco
Central Emergency Hospital
Tel Hemlock 1 ?800

Children's Hospital
Tel Bayview 1 200

San Jose
San Jose Emergency First Aid Station
Tel Cypress 2 3141

San Leandro
Fairmount Hospital of Alameda County
Tel Elgin 1 800

San Mateo
Community Hospital of San Mateo
Tel Fireside 5 2721

Santa Clara County
Santa Clara County Hospital
Tel Cypress 3 0?62

San Rafael
Marin General Hospital
Tel Glencourt 3 3110

COLORADO

Denver
Department of Health and Hospitals
Tel Tabor 5 1331

CONNECTICUT

Bridgeport
Bridgeport Hospital
Tel Edison 4 0131

St Vincent's Hospital
Tel Forest 6 3601

Hartford
St. Francis Hospital
Tel Chapel 9 8?81

Middletown
Middlesex Memorial Hospital
Tel Fireside 8 2681

New Britain
New Britain General Hospital
Tel Baldwin 3 ?761

Stamford
Stamford Hospital
Tel Fireside 8 ?6?1

Waterbury
St Mary's Hospital
Tel Plaza 6 8?31

DELAWARE

Wilmington
Delaware Hospital
Tel Olympia 5 3389

DISTRICT OF COLUMBIA

Washington
Children's Hospital
Tel Dupont 7-4220 Ext 250

FLORIDA

Daytona Beach
Halifax District Hospital
Tel Clinton 2 5561

Fort Lauderdale
North Broward General Hospital
Tel Jackson 2 3611

Fort Myers
Lee County Hospital
Tel Edison ? 1141

(continued)

POISON CONTROL CENTERS

GAINESVILLE
Alachua General Hospital
Tel Franklin 2-4321

JACKSONVILLE
St Vincent s Hospital
Tel Evergreen 9 7761

LAKELAND
Morrell Memorial Hospital
Tel Mutual 4 4211

MIAMI
Jackson Memorial Hospital
Tel Franklin 1 9611

MIAMI BEACH
Mt Sinai Hospital
Tel Jefferson 8 8421

OCALA
Munroe Memorial Hospital
Tel Marion 2 4211

ORLANDO
Orange Memorial Hospital
Tel Orlando 3 5511

PANAMA CITY
Memorial Hospital of Bay County
Tel Sunset 5 7411

PENSACOLA
Baptist Hospital
Tel Hemlock 8 5423

ST PETERSBURG
Mound Park Hospital
Tel Mound Park 5 1181

SARASOTA
Sarasota Memorial Hospital
Tel Ringling 6 8831

TALLAHASSEE
Tallahassee Memorial Hospital
Tel [illegible] 8060

TAMPA
Tampa Municipal Hospital
Tel 8-4321

WEST PALM BEACH
Good Samaritan Hospital
Tel Temple 3 1741

GEORGIA

ALBANY
Phoebe Putney Memorial Hospital
Tel Hemlock 6 3391

ATLANTA
Grady Memorial Hospital
Tel Cypress 4711

Department of Pharmacology
Emory University School of Medicine
Tel Drank 3 1621

AUGUSTA
University Hospital
Tel Park 2 7731

Department of Pediatrics
Medical College of Georgia
Tel Park 4 7461

COLUMBUS
The Medical Center
Tel Fairfax 2 2521

FORT OGLETHORPE
Tri County Hospital
Tel 84 2654

SAVANNAH
Memorial Hospital
Tel Elgin 5 3200

HAWAII

HONOLULU
Kauikeolani Children's Hospital
Tel 5-4563

ILLINOIS

AURORA
St Charles Hospital
Tel 8714

CHICAGO
Mercy Hospital
Tel Victory 2-4700

EFFINGHAM
St Anthony's Hospital
Tel 850

EVANSTON
Evanston Hospital
Tel Greenleaf 5 2500

St Francis Hospital
Tel Davis 8 ?200

Community Hospital
Tel University 4 9400

GRANITE CITY
St Elizabeth's Hospital
Tel Triangle 6 2070

JOLIET
Will County Health Dept
Tel Saratoga 6 6?95

KANKAKEE
St Mary's Hospital
Tel 3 4451

SPRINGFIELD
Memorial Hospital
Tel 2 3361

St John's Hospital
Tel ? 6881

INDIANA

EAST CHICAGO
St Catherine Hospital
Tel Export 7 3080

ELKHART
Elkhart General Hospital
Tel 3 5350

HAMMOND
St Margaret Hospital
Tel Westmore 2 2300

INDIANAPOLIS
Poison Control Center
Tel Walnut 5 1677

General Hospital
Tel Melrose 6 6331

IOWA

DES MOINES
Iowa Poison Information Center
Tel Atlantic 8 7111

FORT DODGE
Lutheran Hospital
Tel 4 0911

KANSAS

TOPEKA
Stormont Vail Hospital
Tel Topeka 5 2361
Ext 216

KENTUCKY

FORT THOMAS
St Luke's Hospital
Tel Hiland 1 1600 Ext 74

LEXINGTON
Baptist Hospital
Tel 4 8820

(nu u d)

Poison Control Centers

Louisville
Louisville General Hospital
Tel Juniper 2 1831

Paducah
Western Baptist Hospital
Tel 5 6361 Ext 21

LOUISIANA

New Orleans
Louisiana State University School of Medicine
Tel Magnolia 6692

MARYLAND

Baltimore
Baltimore City Hospital
Tel Dickens 2 5400

Johns Hopkins Hospital
Tel Orleans 5 5500

University of Maryland Hospital
Tel Lexington 9 0520

Bethesda
Suburban Hospital
Tel Oliver 4 6750

MASSACHUSETTS

Boston
Children s Medical Center
Tel Beacon 2 7800

New Bedford
St Luke s Hospital
Tel Wyman 9 6211
Ext 359

Springfield
Dept of Public Health
Tel Republic 9 2536

Worcester
Worcester City Hospital
Tel Pleasant 6 1551

MICHIGAN

Battle Creek
Calhoun County Health Dept
Tel Woodword 2 6781

Detroit
Herman Kiefer Hospital
Tel Trinity 2 3334

Flint
Hurley Hospital
Tel Cedar 2 1161

Grand Rapids
Butterworth Hospital
Tel Glendale 1 3591

Blodgett Memorial Hospital
Tel Glendale 6 5301

St Mary s Hospital
Tel Glendale 9 3131

Pontiac
St Joseph Mercy Hospital
Tel Federal 4 3511

Port Huron
Mercy Hospital
Tel Yukon 5 9531

MINNESOTA

Mankato
Immanuel Hospital
Tel 8 1606

Minneapolis
Minnesota State Department of Health
Tel Federal 9 7751

North Memorial Hospital
Tel Juniper 8 2753

Northwestern Hospital
Tel FE 2 7266

Minneapolis General Hospital
Tel Federal 3 1178

St Cloud
St Cloud Hospital
Tel Blackburn 2700

St Paul
Bethesda Hospital
Tel Capital 4 7561

The Children s Hospital
Tel Capital 7 6521

St John s Hospital
Tel Prospect 1 5521

St Luke s Hospital
Tel Capital 4 6501

MISSISSIPPI

Laurel
Jones County Community Hospital
Tel 8 7236

MISSOURI

Cape Girardeau
St Francis Hospital
Tel ED 5 3375

Kansas City
Kansas City General Hospital #1
Tel Harrison 1 8060

Mercy Hospital
Tel Grand 1 5250

St Louis
St Louis Children s Hospital
Tel Forest 7 6880

Homer G Phillips City Hospital
Tel Franklin 1 3100

St Louis City Hospital
Tel Central 1 7300

Cardinal Glennon Memorial Hospital for Children
Tel Mohawk 4 7222

NEBRASKA

Omaha
Children s Memorial Hospital
Tel Glendale 5400

NEW JERSEY

Atlantic City
Atlantic City Hospital Poison Control Center
Tel Atlantic City 5 2112

Camden
West Jersey Hospital
Tel Woodlawn 3 8830

Long Branch
Monmouth Memorial Hospital
Tel Capitol 2 5200

Montclair
Mountainside Hospital
Tel Pilgrim 6 6000

Morristown
All Soul s Hospital
Tel JE 8 0900

(continued)

POISON CONTROL CENTERS

Memorial Hospital
Tel JE 8-4500

NEPTUNE
Fitken Memorial Hospital
Tel Prospect 5 5500

NEWARK
Babies Hospital
Tel Humboldt 2 6200

NUTLEY
The Nutley Child Safety Program
Tel Nutley 2 0139

SOUTH ORANGE
Orange Memorial Hospital
Tel 5 1100

NEW MEXICO

ALAMOGORDO
Poison Control Center
Tel 204

NEW YORK

NEW YORK CITY
New York City Department of Health
Tel Worth 4 3800
Ext 680

ALBANY
Albany Hospital
Tel Albany 8-4541

BUFFALO
Buffalo Children s Hospital
Tel Summer 5 1000
Ext 242

ELMIRA
St Joseph s Hospital
Tel 6241

NIAGARA FALLS
Niagara Falls Memorial Hospital
Tel 5761

ROCHESTER
Strong Memorial Hospital
Tel Greenfield 3 4400
Ext 224

SYRACUSE
City Hospital
Tel Granite 6 3166

NORTH CAROLINA

DURHAM
OPD Duke University Hospital
Tel Durham 9011
Ext 398

JACKSONVILLE
Onslow Memorial Hospital
Tel 7241

NORTH DAKOTA

BISMARCK
Quain and Ramstad Clinic
Tel Capitol 3 1490

FARGO
The Dakota Clinic
Tel Adams 5 6466

GRAND FORKS
Medical School
University of North Dakota
Tel 4 6211

OHIO

AKRON
Children s Hospital
Tel Blackstone 3 5531

CINCINNATI
The Kettering Laboratory
Tel CA 1414

CLEVELAND
Cleveland Academy of Medicine
Tel Cedar 1 3500

COLUMBUS
The Children s Hospital
Tel Clearbrook 8 978.

MANSFIELD
Mansfield General Hospital
Tel 4?71 6

TOLEDO
Poison Information Center of Greater Toledo
Tel Cherry 4 1961

OKLAHOMA

OKLAHOMA CITY
University of Oklahoma Medical Center
Tel RE 6 1511 Ext 358

OREGON

PORTLAND
Oregon Poison Control Registry
Tel Capitol 8 9181 (day)
Capitol 8 5546 (night)

PENNSYLVANIA

ALLENTOWN
Allentown Hospital Assoc
Tel Hemlock 4 7161

DANVILLE
George F Geis nger Memorial Hospital
Tel 1250

ERIE
Hamot Hospital Assoc
Tel 2 6991

HA ISBURG
Harrisburg Hospital
Tel Cedar 8 5?21

Polyclinic Hospital
Tel CE 8 7361

LANCASTER
St Joseph Hospital
Tel Express 4 7181

PHILADELPHIA
Ph ladelphia Department of Public Health
Tel WA 2 5524

SHARON
Sharon General Hospital
Tel 7 7701

WILKES BARRE
Mercy Hospital
Tel Valley 2 8101

SOUTH CAROLINA

COLUMBIA
Columbia Hospital
Tel Alpine 4 7387

SOUTH DAKOTA

VERMILLION
Dept of Pharmacology
University of South Dakota
Tel Market 4 4411

TENNESSEE

JACKSON
Madison General Hospital
Tel 7 9651

(co t ued)

Poison Control Centers

Knoxville
University of Tennessee Memorial Research Center and Hospital
Tel 4 2961

Memphis
Le Bonheur Children s Hospital
Tel Jackson 5 6541

Nashville
Vanderbilt Hospital
Tel 9 5651

TEXAS

Corpus Christi
Memorial Hospital
Tel Tulip 4 2411

Fort Worth
W I Cook Memorial Hospital Center for Children
Tel Fortune 5521

Galveston
John Sealy Hospital
Tel Southfield 5 5541

Houston
Baylor University College of Medicine
Tel Jackson 9-4951

UTAH

Salt Lake City
Salt Lake County Hospital
Tel Hunter 4 8612
Ext 334

VIRGINIA

Portsmouth
U S Naval Hospital
Tel Export 9 2441

Richmond
Medical College of Virginia
Tel Richmond 7 9851

WASHINGTON

Seattle
Children s Orthopedic Hospital
Tel Fillmore 4500

Spokane
Deaconess Hospital
Tel RI 7 4811

WEST VIRGINIA

Pine Grove
The Pine Drug Store
Tel Tuxedo 9 8500

WISCONSIN

Milwaukee
F J Mellencamp M.D
Chairman Poison Control Committee
Tel Woodruff 2 9700

APPENDIX D 6

Evaluation of the Psychotic Patient and the Mental Status Examination

INTRODUCTION

Whenever the patient is suspected of being psychotic the following mental status examination should be employed It is to be used only as a guide so that its continued use will enable the examiner to learn methods of obtaining data intelligently from others and from the patient One of the significant differences in the examination of a psychotic patient is that the history obtained from the patient must be supplemented by information from relatives neighbors ministers other physicians social workers etc who know the patient If possible these informants should be seen when the patient is brought to the hospital Often these interviews will indicate errors discrepancies and omissions in the history or will define more clearly the patient s statements A number of such interviews frequently are required to obtain a correct estimate of the family structure and a satisfactory account of the patient s life experiences and the development of the present illness At times the psychotic patient is unable to give any reliable history nevertheless what he does say should be recorded although most of the data will have been obtained from other persons

Mental illness frequently arouses resentment, guilt and anxiety in relatives These may manifest themselves by attitudes of defensiveness shame anger or bewilderment. The *doctor should be aware of this and attempt to make each interview* an exercise in psychotherapy In addition to obtaining much information from family members, the interviews should orient the family members allay some of their anxiety and give them a better understanding of the causes of emotional illness The members of the family should be encouraged through their interest in the patient to share as much information as possible with the physician They may also be told in general terms about some of the problems that the patient is

facing Obviously with improved understanding on the part of the relatives they will become more cooperative in following through recommendations for further care or hospitalization changes in the home and attitudes toward the patient However such discussions with the relatives should avoid the extremes of alarmism or undue optimism In speaking to them one should use language which is understandable in terms of their own culture pattern Special care should be exercised in protecting the patient s interests and not giving the relatives information that could be used against him or that could be misinterpreted by the family After the initial interview the family should be urged to ask for conferences whenever the physician feels they are indicated and they should be kept informed of the patient s progress When further information is needed from social health and judicial agencies in the community the physician usually will be helped considerably by referring such matters to the psychiatric social worker

In addition to historical data from the patient and others the mental status examination will help the examiner to detect slight or marked abnormalities in the thought processes and actual experiences of the patient This examination is not a legal inquiry but an outline to facilitate understanding of the patient s problems and observation of pertinent aspects of his behavior

MENTAL STATUS EXAMINATION

1 General Description

A short description of what nurses students physicians and others in contact with the patient have observed

A Dress Neat untidy eccentric appropriate to the occasion etc

B Posture Relaxed rigid tense erect recumbent etc

C Facial expression Mobile fixed ecstatic depressed angry etc

D Attitude Friendly aggressive cooperative resistive negativistic etc

E General mood Objective statements *from observation* —calm elated anxious irritable depressed tearful listless note variations and discrepancies between mood

and thought content and changes of mood at different times of the day

F MOTOR ACTIVITY Under or overactivity dystonia aim less movements

2 Stream of Talk

Rate quality amount and form under pressure retarded blocked relevant logical coherent concise illogical disor ganized flight of ideas neologisms word salad circum stantial rhyming punning loudness whispering screaming etc

3 Subjective Emotional Reaction and Mood

In contrast to observed mood data on subjective mood are obtained by answers to questions such as How do you feel? What part of the day is most pleasant? Most difficult? Do you become angry depressed irritable frightened pan icky? When? Why? At times do you feel you d rather die than continue this way?

4 Content of Thought

Great care must be exercised here to avoid direct question ing or to follow slavishly the outline Many patients will not answer or will get angry if asked Do you hear voices? or Do you see people who you know aren t there? Yet these same patients may have hallucinations and can be much relieved if they are allowed tactfully to share these disturbing experiences with a physician At one point or another they may need reassurance They may ask for it saying Doctor this sounds crazy They should be reassured told that such things happen quite frequently to people under emotional stress

A OBSESSIONS COMPULSIONS AND PHOBIC THOUGHTS Do you have thoughts that you are unable to control or rid yourself of? Do you fear storms heights crowds traffic? Are you compelled to follow a certain ritual while dressing eating or walking etc? Do you feel tense if the foregoing are not done?

B FEELINGS OF UNREALITY AND DEPERSONALIZATION Do you feel as if you were in a fog? Do things look dim or distant to you? Do things look as if they were in a dream? Do things that happen to you seem unreal? Do you feel unnatural?

C DELUSIONS—(This area should be approached gradually) Have you had any unusual unpleasant or perplexing experiences? Have you had any peculiar thoughts dreams imaginings? Does the patient express ideas which are clearly in error?

D PERSECUTORY TRENDS Are you considered friendly and popular? Do people like you? Do they talk about you? Are you suspicious of others? Do you feel wronged annoyed poisoned? How do you explain this?

E PASSIVITY FEELINGS Do you think others may be able to influence you? How? Do you think some people can read minds? Can they read yours? Control you? How?

F SOMATIC TRENDS Has any part of your body changed? Inquire about elimination senses digestion pain sweat genitals sexual powers

G ILLUSIONS (These are important in the examination of delirious patients although usually the presence of illusions is established on objective evidence) Do shadows or noises look peculiar or frightening to you? Do body sensation lead you to think you are being touched?

H HALLUCINATIONS This area should be approached gradually

1) *Auditory*— Do you hear buzzing in your ears? Noises? Do you know of anybody who ever heard noises? Did anything like this ever happen to you?

2) *Visual*— Have you seen any flashes of light? Did you ever imagine you saw things as if in a dream Have you imagined that you saw things and people and wondered whether you were dreaming or awake?

3) *If hallucinations are acknowledged ask*—

a) Auditory— What do they say? Pleasant? Unpleasant? Whose voice? Man? Woman? In both ears? What does it mean? Are they talking to you About you?

b) Visual— At night or day? Eyes open or shut? Where? What or whom do you see? What does it mean?

c) Gustatory— Do things taste the same? Peculiar?

d) Olfactory— Have you noticed any queer odors?

5 Sensorium Examination

This is particularly important when delirium or dementia is suspected Its careful use will test attention memory grasp of general information and capacity for logical thought Frequently this part of the examination may annoy or provoke the patient, as he is apt to equate direct ques tioning in areas of attention memory and information as tests of intelligence As a matter of fact much of what follows may be obtained casually and indirectly in eliciting the historical data in the conventional manner Information concerning orientation and memory can be obtained by asking when the patient came to the hospital or about events which have transpired since his admission etc It is best when possible to avoid direct questioning and obtain information through indirect and casual means

In instances in which the examiner feels that more comprehensive psychologic tests are indicated he may ar range an appointment for the patient with a clinical psy chologist The psychologist may administer the projective tests as well as the more conventional psychologic tests

A ORIENTATION Is he oriented for time (day month year) place person and situation? Does the patient recognize doctors nurses?

B MEMORY

1) *Remote past*—Use questions that can be checked such as How old are you? When were you born? When married? What age? Date of birth of children?

2) *Recent past*— Home address? Telephone number? When and how did you come to the hospital? Events in the past 24 hours? What happened when you first arrived in the hospital?

3) *Retention and recall*—Repeat forward 31759 or 42385 (7th year) repeat reversed 6528 or 4937 (9th

year) repeat reversed 15286 or 69482 (14th year) recall 375 Vine Street after 5 minutes 1 hour next day etc

C GRASP OF GENERAL INFORMATION Name governor mayor last 5 presidents (3 is average) 4 large cities wars current events etc

D CALCULATIONS Multiplication addition count coins simple arithmetical problems (may have been obtained from asking patient his age ages of children etc)

E READING WRITING AND SPEECH Use test phrases obtain writing specimen to paste in the chart describe speech and writing have patient read Cowboy Story and note if patient gets meaning and can tell story note character of reading memory lapses errors and con fabulation

A cowboy from Arizona went to San Francisco and took his dog which he left at a friend s while he pur chased a new suit of clothes Dressed finely he went back to the dog whistled to him called him by name and patted him However the dog would have nothing to do with him in his new hat and coat and gave a mournful howl Coaxing was of no avail so the cowboy went away and donned his old garments whereupon the dog immediately showed his wild joy on seeing his master as he thought he ought to be

F LEVEL OF AWARENESS

1) *Attention span*—serial subtraction of 7 s or 3 s from 100 (This test is dependent on at least a grammar school education) Attention should be paid to the manner in which the test is performed It is not only a test of arithmetical ability but taxes continu ously and repeatedly the ability to attend and con centrate and is one of the most valuable tests in detecting slight chang s in attention produced by delirium Long before arithmetical error is apparent the patient may betray his decreasing ability to per form the task by heightened effort perseveration increase in total time of the test frequent hesitation or questioning requesting a new start or becoming irritable depreciating the test and the examiner

2) *Judgment*—does the patient show good or poor

judgment in general activities? Does he give due value to practical considerations? Can he distinguish between lie and mistake dwarf and child idleness and laziness poverty and misery character and reputation? Plans for the future Is judgment better on impersonal than on personal matters?

3) *Abstractions*—inquire about the meaning of proverbs such as A squeaking wheel gets the grease A rolling stone gathers no moss The apple falls near its tree The tongue is the enemy of the neck Note whether (1) interpretation is literal (2) the meaning of the proverb is understood (3) the patient sees any relationship to his personal situation and (4) all proverbs are interpreted in the light of his personal problems
4) *Insight*—(*a*) Give a verbatim statement of the patient s formulation of himself in his pre ent situation (*b*) Is the patient aware of mental or physical defects? Does he realize that the difficulty is within himself or does he ascribe it to external sources? (*c*) Does he make any statement as to the emotional nature of his illness? Has he any insight into etiologic or dynamic factors?

APPENDIX D 7

Evaluation of the Comatose, Stuporous, or Uncooperative Patient

INTRODUCTION

The comatose patient must be examined rapidly Necessary supportive therapy should be initiated immediately and continued even during the examination The stuporous or uncooperative patient should be closely observed until assistance is available for examination A number of important observations

have to be made quickly to reach a diagnosis and make a decision as to treatment

Negativism, stupor catatonia agitation or coma should be distinguished and recorded when the patient is in such a state To wait for a clinical picture to change is to miss an opportunity and leave a gap in the clinical examination detrimental to the patient

These states may be associated with a wide variety of neurologic metabolic circulatory toxic traumatic or psychiatric disorders so it is essential to investigate the patient s immediate status in accordance with a definite plan

HISTORY

1 General

Obtain as accurate an account as possible of the patient s past history recent complaints and the onset early and late symptoms of the present illness Inquire about the duration of any lucid intervals and the period of secondary unconsciousness *Do not allow relatives friends passers by or the police to leave until they have been questioned by the physicians who will ultimately be in direct charge of the patient If necessary send the police or a social worker after them Identify the informant for each item in the history*

2 Injury

Get specific details of the time type and place of accident particularly in the case of head injuries Inquire about the patient s state of responsiveness and behavior during and after the accident from the patient if possible or any available witness Remember that the case may have medicolegal implications

3 Drug Ingestion

Inquire specifically about alcohol (do not let a history of ingestion lead you to overlook a possible head injury) Antabuse barbiturates bromides opiates tranquilizers

salicylates nose drops cyanide or other poisons (See Appendix D 5 p 88 for Poison Control Centers)

4 Metabolic Diseases

Inquire about a history of diabetes look for a diabetic identification card or needle marks consider both acidosis and hypoglycemia Inquire about renal or liver disease and consider uremia and hepatic coma Eclampsia in the female and the possibility of thyrotoxicosis myxedema and pellagra should be considered

5 Central Nervous System Diseases

Inquire about a history of severe headaches hypertension or epilepsy and think especially of cerebral vascular accidents (subarachnoid hemorrhage cerebral thrombosis cerebral emboli) consider hypertensive encephalopathy subdural or epidural hematoma brain tumor CNS syphilis and carcinomatosis Obtain a precise description of any convulsion Before concluding that seizures have not occurred inquire using commonly understood terms like falling out blackout, fit petit mal and grand mal are not terms which constitute an adequate description of a convulsion to the layman

6 Circulatory System

Inquire about heart disease in particular mitral stenosis coronary artery disease aortic stenosis angina pectoris heart block (Stokes Adams) carotid sinus sensitivity arrhythmias and cardiac failure Consider shock from acute hemorrhage chronic blood loss or a blood dyscrasia such as pernicious anemia Vasodepressor syncope is of brief duration and the patient usually recovers promptly when placed horizontally

7 Physical Agents

Consider heat stroke or exhaustion electric shock burns and drowning

8 Chemical Agents

Consider carbon monoxide industrial and agricultural poisons kerosene cleaning fluids and insect spider and reptile bites

9 Infections

Consider recent fevers rashes insect bites upper respiratory infection pneumonia tuberculosis severe influenza meningitis encephalitis dysentery and any infections with high fever

10 Psychiatric Disorders

Catatonic schizophrenia hysteria acute mania and panic states

EXAMINATION

Examination may be made in a matter of minutes and if necessary the observer should have 1 or more assistants Always have the patient s pulse blood pressure respirations and temperature if necessary recorded at frequent intervals and charted on a special graph

1 Respiration

Investigate the possibility of respiratory obstruction first If there is evidence of obstruction correct at once mouth gag oropharyngeal airway laryngoscopy and intubation or tracheotomy

- A KUSSMAUL RESPIRATION (deep and sighing) Diabetic acidosis uremic acidosis diarrhea salicylism and other causes of acidosis
- B INCREASED RATE Systemic infection carbon monoxide poisoning and irritant poisons
- C DECREASED RATE Expanding intracranial lesions alcohol opiate and barbiturate poisoning nose drops in infants electric shock kerosene poisoning
- D STERTOROUS RESPIRATIONS Cerebral vascular accident obstruction to airway

2 Blood Pressure

If there is evidence of shock (decreased or undetectable blood pressure thready pulse pallor or sweating) start correction at once with parenteral fluids and volume expanders Cross match blood for transfusion

A INCREASED Cerebral vascular accident carbon dioxide retention expanding intracranial lesion uremia eclampsia hypertensive encephalopathy

B DECREASED Diabetic acidosis shock from hemorrhage or trauma alcoholism opiate and barbiturate poisoning carbon monoxide poisoning heat exhaustion

3 Pulse Rate

A RAPID Diabetes (acidosis and hypoglycemia) alcoholism eclampsia hemorrhagic or neurogenic shock coma heat stroke paroxysmal tachycardia

B IRREGULAR Cardiac decompensation arrhythmias carbon monoxide poisoning

C SLOW PULSE Increased intracranial pressure heart block opiate and barbiturate poisoning hyperkalemia

After correction of respiratory obstruction and shock has been instituted the examination can be completed

4 Obvious Injury

Look carefully for local injury e g scalp tongue chest concealed bleeding epilepsy burns asymmetry of trunk or extremities hemiplegia

5 Breath Odor

Alcohol (intoxication and trauma) fruity or rotten apples (diabetic acidosis) sweetened (fetor hepaticus) urinniferous (uremia) illuminating gas (carbon monoxide poisoning) kerosene

6 Color of Skin and Mucous Membranes

Note any trauma or bleeding hyperemia—acute alcoholism cherry red—carbon monoxide poisoning cyanosis

—respiratory obstruction or insufficiency cardiac decompensation meningitis eclampsia postictal state pneumonia methemoglobinemia pallor—shock hemorrhage anemia jaundice—hepatic coma acute surgical abdomen spiders rashes—meningococcal meningitis typhus measles bromism needle punctures—diabetes narcotic addiction

7 Temperature

Axillary temperatures are unreliable Mouth temperatures should not be attempted in the presence of coma Rectal temperatures should be used generally but not in pregnant or bleeding females except under direct supervision of a physician

A. ELEVATED Meningitis encephalitis dysentery severe general infection heat stroke hepatic coma paroxysmal tachycardia salicylism
B LOWERED Carbon monoxide poisoning alcoholism barbiturate poisoning exposure

8 Skull Damage

Note the position and any deformities of the head assess the injury by examining scalp lesions and the extent of skull damage look for bloody or watery discharge from ears or nose but do not probe

9 Other Signs

A CONVULSIONS Epilepsy tetany cerebral vascular accident alcoholism eclampsia CNS syphilis encephalitis meningitis hypoglycemia rapid rise of temperature in children hypertensive encephalopathy
B VOMITING Increased intracranial pressure
C MUSCLE TWITCHING Uremia poisoning
D ABDOMINAL MASSES Eclampsia (pregnancy) acute surgical abdomen hepatic enlargement subcapsular rupture of liver or spleen aneurysm ascites acute urinary retention (always percuss the bladder area)

E WOUNDS OF THE TONGUE Suggestive of preceding convulsions

F SOFT EYEBALLS Dehydration as in diabetic acidosis

10 Neurologic Examination

A MENINGEAL SIGNS Stiff neck Kernig s sign Brudzinski s sign

B PUPILS Pinpoint dilated unequal reaction to light do not use mydriatics record pupillary size diagrammatically Note especially the dilated, fixed pupil

C FUNDI Papilledema hemorrhage exudates

D OCULAR AND FACIAL MUSCLES Facial weakness asymmetry corneal reflexes deviation of tongue drooling from the side of the mouth irritability of facial muscles

E MOTOR SYSTEM Paralysis muscle tone twitchings clonus patterns of convulsions (describe in detail) respiratory paralysis

F TENDON REFLEXES Note the activity and quality clonus abnormal reflexes

G SENSORY SYSTEM Response to pain withdrawal thumb pressure over the exit foramina of the supra orbital nerves is a fairly accurate and consistent means of assessing levels of pain response

H CONSCIOUSNESS AND AWARENESS Changes in level

I INCONTINENCE OF URINE AND FECES

J COORDINATION Note spontaneous movements

K MAKE A DETAILED NEUROLOGIC EXAMINATION as soon as feasible (see Appendix D 3 p 7?)

11 Laboratory Examination

A URINALYSIS (catheterize when indicated) Complete analysis If acetone is present test for salicylates

B BLOOD COUNTS White cell count do a differential, hemoglobin and packed cell volume if indicated

C X RAYS

1) *Skull x rays*—do these in cases of obvious or suspected trauma when the patient s general condition permits but it is useless to attempt them with

restless or confused patients unless they can be safely moved and held firmly

2) *Chest films*—should be taken in children

3) *Any suspicious or questionable area of the body*—but only when the patient can be safely immobilized and moved

D BLOOD CHEMICAL DETERMINATIONS Blood sugar if the patient is diabetic or sugar or acetone is present in the urine BUN CO in all except obvious cases bromide level when indicated STS routinely

E BLOOD CULTURES Should be drawn when systemic infections are suspected

F LUMBAR PUNCTURE Should be considered only after evaluation of other evidence Cells protein STS culture and sugar if indicated *Do not do a lumbar puncture in the presence of increased intracranial pressure papilledema or an obviously expanding intracranial lesion*

G GASTRIC LAVAGE This is dangerous in the presence of deep coma but not gastric aspiration if acute gastric dilatation is suspected

H ELECTROENCEPHALOGRAMS These are not usually helpful in emergencies

12 Psychiatric Examination

When the preceding examinations have yielded no other likely etiology psychiatric evaluation may be conducted along the lines previously indicated (see Appendix D 6 p 97) It is of great help to the psychiatrist to keep the informants present *until he has had a chance to interview* them

PART II

Laboratory Procedures and Examinations

1 Hematologic Procedures

COLLECTION OF BLOOD

1 Capillary Blood

This is obtained by puncture of the skin with a sterile new or autoclaved lancet The instrument must not be reused on another patient unless it is first reautoclaved for fear of transmitting the virus of homologous serum hepatitis sterilization by boiling is not adequate

2 Blood from a Large Vessel

This blood (ordinarily taken from a vein) should be obtained as nearly as possible without stasis in order to avoid alteration of concentration of formed elements The puncture should be clean since lack of free flow and introduction of air bubbles may adversely affect the determination of erythrocyte number packed cell volume sedimentation rate and clotting factors due to hemolysis and/or partial coagulation The blood should be transferred with a minimum of delay to the appropriate container after first removing the needle to minimize hemolysis If however a smear is to be made this is first prepared from a drop of blood from the needle or syringe tip before transfer of the contents of the syringe Bottles containing anticoagulant should be shaken at once When blood from an anticoagulant bottle is used a uniform suspension of cells must be assured by inverting the bottle at least 50 times followed by prompt removal of the sample

3 Anticoagulants

Anticoagulants used for hematologic studies are Sequestrene sodium, the double oxalate mixture of Heller and Paul and

heparin Sequestrene sodium which is a chelating agent binding ionized calcium is satisfactory for most routine purposes The optimum quantity for preventing coagulation of 5 ml of blood is 5 mg but this will prevent coagulation of quantities of blood from 1 to 8 ml without altering packed cell volume or affecting sedimentation rate Sequestrene dipotassium is more soluble but produces shrinking of red cells

Heparin solution may be used occasionally for special studies but it is not used routinely because in the concentration necessary for complete and prolonged anticoagulation it favors the agglomeration of large rouleaux and thus may spuriously augment sedimentation rate Clumping of leukocytes and red blood cells may interfere with their enumeration but it does not affect the determination of packed cell volume

The double oxalate mixture (potassium oxalate 4 mg ammonium oxalate 6 mg for 5 ml of blood) is entirely satisfactory for most purposes Alterations in this proportion or single oxalate salts may produce drastic alterations in the red cell volume

Morphologic distortion of leukocytes may result from any of the anticoagulants particularly oxalates so that smears for morphologic study must be made from fresh blood without the addition of anticoagulants

VOLUME OF PACKED RED CELLS (Vc)

Two techniques are commonly available for this determination—the macrotechnique using the Wintrobe hematocrit and a microtechnique using capillary tubes Hematocrits of different design are used in some institutions but the principles involved are similar to those of the Wintrobe tube The *micro method* has a slightly greater range of error and can be performed only in a special centrifuge designed for capillary tubes It is useful as a screening procedure for anemia since capillary blood may be used

The *macro method* is performed by filling the Wintrobe hematocrit precisely to the 10 1 mark with blood from an anticoagulant bottle This will bring the bottom of the meniscus to the 10 mark The tube is then balanced and centrifuged for

at least 30 minutes For maximum packing the centrifuge must provide a relative centrifugal force of 2260 × G This may be achieved in most large floor centrifuges or at the highest rheostat setting in certain table centrifuges

After centrifugation read the volume of packed red cells (Vc) to the nearest 0 1 mm In angle head centrifuges the upper level of the red cell column will slope the reading is made midway on the slope

In addition to the volume of packed red cells it is possible to estimate roughly the volume of packed leukocytes and platelets and the icterus index of the plasma with the Wintrobe tube Better separation of leukocytes and platelets in the hematocrit will be obtained if the blood is allowed to sediment for an hour and is centrifuged at low speed for 10 minutes before full speed centrifugation

HEMOGLOBIN

The only reasonably accurate method for routine use is the photometric estimation of the optical density of a solution of oxyhemoglobin (HbO) or better still a derivative such as cyanmethemoglobin (MHbCN) or alkaline hematin The accuracy of such techniques is usually better than 5% Visual colorimetry employing the less stable and somewhat cloudy solution of acid hematin is still in general use in experienced hands its potential inaccuracy is 2 to 3 times that of good photometric techniques

1 Photometric Determination of Hemoglobin as Cyanmethemoglobin

An accurately measured volume of blood is diluted in an accurately measured volume of solution that will convert hemoglobin to cyanmethemoglobin The optical density of this solution is compared with that of a known standard in a photoelectric colorimeter The diluent solution contains potassium cyanide potassium ferricyanide and sodium bicarbonate For most colorimeters 20 cu mm of blood is diluted in 5 ml of solution and read after at least 10 minutes have elapsed to allow for conversion of all hemo-

globin to cyanmethemoglobin The advantage of this method over other photoelectric methods is that cyanmethemoglobin is a very stable pigment and standard solutions are available from outside sources so that a single standard may be used for different instruments and in different institutions

2 Visual Colorimetric Determination of Hemoglobin as Acid Hematin (Sahli Method)

This is a commonly used method in laboratories where the number of hemoglobin determinations is insufficient to warrant the purchase of a photoelectric colorimeter

A Fill the calibrated tube approximately to the 2 Gm mark with 0 1 N HCl using a dropper

B Fill the pipette accurately to the 0 02 ml mark with blood from a cutaneous puncture or anticoagulant bottle (The use and care of the Sahli pipette is the same *as described below for hemocytometer and pipettes*)

C *Wipe off blood* adhering to the outside of the pipette

D Expel the blood *into the acid in the tube This must be* done slowly with gentle agitation of the tube avoid *forming* bubbles The *pipette is* then rinsed 3 times by slowly drawing in and discharging acid from the tube

F Mix the contents of the tube with a stirring rod

F Allow the tube to stand The development of color is gradual and becomes asymptotic reaching 95% of maximum in about 10 minutes 98% in about 20 minutes For this reason a standard time should be selected Twenty minutes is often too long for practical purposes so that 10 minutes may be used if the instrument is standardized for this interval

G Dilute the hematin solution by adding distilled water 1 *drop at a time and mixing with the stirring rod until* the color matches that of the brown glass The light source should be constant daylight is best but since this is not always available the usual procedure is to use a blue filtered substage lamp

H When the color matches read the hemoglobin concentration on the side of the tube in grams per 100 ml of blood Ignore the calibration in per cent

I The instrument should be standardized periodically against a standardized photoelectric colorimeter

ERYTHROCYTE AND LEUKOCYTE COUNTS

1 Care of Hemocytometer and Pipettes

The hemocytometer and its special optically plane cover glass must be cleaned with soap and water and thoroughly rinsed and dried before use Care should be taken to avoid scratching their surfaces Lint on the inferior surface of the cover slip or on the supporting shoulders of the hemocytometer will introduce error by increasing the volume of blood to be examined Lint and grease will interfere with the dispersion of blood cells Ordinary coverglass may not be used as hemocytometer covers

Pipettes must be filled accurately with blood to the proper mark If the blood column rises to no more than 2 mm above the mark it may be drawn down to the mark by lightly touching the pipette tip to the finger If the sample rises to more than 2 mm above the mark the pipette must be cleaned and the procedure begun anew

The hemocytometer is filled by capillary attraction of diluted blood from the pipette tip held at the edge of the chamber Slight overflow into the trenches may be immediately corrected by touching the edge of the chamber with gauze or filter paper If there is more than slight overflow the chamber and cover slip must be cleaned and dried and the filling begun anew

A systematic technique of counting cells as outlined in handbooks of laboratory procedures should be followed in order to avoid duplications and omissions

Pipettes are cleaned by sucking out the diluted blood and rinsing through 3 times with distilled water They are then dried with acetone or with alcohol and ether Occasionally an accumulated film of precipitated protein or grease should be removed by filling the pipette with acid cleaning fluid and permitting it to stand overnight. The mixing bead rolls freely in a clean dry pipette A pipette with a chipped tip is potentially inaccurate and should be discarded

2 Red Blood Cell Count

In the most experienced hands using 2 pipettes and 2 chambers it is difficult to perform an erythrocyte count with accuracy greater than ± 10% For this reason erythrocyte counts are *not* used routinely to determine the presence of anemia their principal usefulness is in the determination of red cell indices and calculation of the absolute numbers of reticulocytes and other formed elements which are enumerated in relation to the number of red cells

A Draw blood from a cutaneous puncture or anticoagulant bottle to the 0 5 mark of the red cell pipette
B Wipe off blood adhering to the outside of the pipette
C Draw in diluting fluid (Gower s solution—12 5 Gm of sodium sulfate and 33 3 ml of glacial acetic acid dissolved in 200 ml of water) to the 101 mark rotating the pipette gently during this process Air must not be trapped in the bulb as filling nears completion
D Prepare hemocytometer and cover for receiving blood (This may of course be done before Step A)
E Shake the pipette for 3 minutes
F Immediately expel at least 4 drops from the pipette to discard the fluid in the capillary portion which should contain no cells and does not participate in the dilution
G Fill both sides of the hemocytometer and allow to stand until settling of cells is complete (about 3 minutes)
H With the high dry lens of the microscope count all cells in 5 of the smaller squares comprising the central large square of the total ruled area (viz the 4 corner and 1 middle square a total of 80 of the smallest squares) Repeat on the other side of the chamber
I Divide the number of cells counted by 200 This is the red cell count in millions per cu mm

3 Calculation of Erythrocyte Indices

A Mean Corpuscular Volume (MCV) The average volume of each red blood cell

$$MCV \text{ in } \mu^3 \text{ (cubic microns)} = \frac{Vc\ (\%) \times 10}{RBC\ (mil/mm^3)}$$

B Mean Corpuscular Hemoglobin Concentration (MCHC) The proportion of hemoglobin present in the average cell

$$\text{MCHC in } \% = \frac{\text{Hgb (Gm /100 ml blood)} \times 10}{\text{Vc } (\%)}$$

C *Mean Corpuscular Hemoglobin (MCH)* The average weight of hemoglobin in each cell

$$\text{MCH in } \mu\mu g \text{ (Micromicrograms)} = \frac{\text{Hgb (Gm /100 ml blood)} \times 10}{\text{RBC (mil /mm)}}$$

4 White Blood Cell Count

With careful technique leukocyte counts performed as described below have a probable error of from ± 10% to ± 20% This is sufficient for most clinical purposes Some what greater accuracy can be achieved by using 2 pipettes and/or 2 chambers

A Draw blood from a cutaneous puncture or anticoagulant bottle to the 0 5 mark of the white cell pipette
B Wipe off blood adhering to the outside of the pipette
C Draw diluting fluid (3 parts acetic acid in 100 parts of water) up to the 11 mark using the same precautions indicated in the procedure for dilution of red blood cells
D Prepare the hemocytometer and cover slip (This may of course be done before Step A)
E Shake the pipette for 3 minutes
F Discard the first 4 drops from the pipette
G Fill 1 side of the hemocytometer and allow to stand until settling is complete (approximately 2 minutes)
H With the low power lens of the microscope count all cells in the corner 4 of the 9 largest squares
I Multiply the number of cells counted by 50 This is the nucleated blood cell count per cu mm of blood If no nucleated red blood cells are present this figure is reported as the white cell count If nucleated red blood cells are present the correction described below is applied

5 Estimation of Nucleated Red Blood Cells

The absolute number of nucleated red blood cells is de termined by applying the following formula based on the

number of nucleated red blood cells per 100 white blood cells as determined on examination of the stained smear
Nucl d RBC/mm³ =

$$\text{Nucl d cells/mm} \times \frac{\text{Nucl d RBC/100 WBC}}{100+\text{nucl d RBC/100 WBC}}$$

The absolute number of nucleated red blood cells is sub tracted from the total nucleated cell count to give the white blood cell count

THE STAINED DRY BLOOD SMEAR

1 General

Smears are made from fresh uncoagulated blood to which anticoagulants have not been added Cover slips and slides even new ones must be cleaned by washing with soap and water soaking in alcohol and polishing with a grease free cloth They should be removed from their containers with forceps and may be handled with the fingers only by the corners and edges

2 Preparation of Dried Film

A COVER SLIP PREPARATION This technique is recom mended since it allows more random distribution of leukocytes

1) Touch the middle of th cover slip held horizontally by 2 adjacent corners between thumb and forefinger to a 2 3 ml drop of blood at a cutaneous puncture site (without touching the skin) or at a needle tip
2) Drop onto this another cover slip held so that the edges of 1 correspond in position to the corners of the other
3) Just before the resultant spreading of the blood is complete quickly pull the cover glasses apart while keeping them in the same plane
4) Permit the 2 films to dry in air

B SLIDE PREPARATION This technique tends to push larger leukocytes to the edges of the smear thus altering their distribution

1) Place 2 small drops of blood near the end of a 1 × 3 in clean glass slide
2) Touch a second glass slide to the first at an angle of

approximately 30 degrees, so that the blood is in the acute angle.

3) Draw the second slide back along the first until the edge touches the blood. Immediately advance the second slide drawing the film of blood behind it in the acute angle.
4) Permit the resulting film to dry in air.

3 Technique of Staining

A. Place the cover slip or slide on a staining rack, film side up.

B. Flood the top surface with Wright's stain (a mixture of acidophilic pink and basophilic blue dyes in absolute methanol), taking care to avoid overflow.

C. Allow stain to remain 1-2 minutes to fix the film on the cover slip.

D. Dilute the stain with distilled water or special buffer solution in an amount approximately equal, drop for drop, to that of the stain, taking care to avoid overflow. A greenish scum should appear on the surface.

E. Allow to stand several minutes, depending on the characteristics of the stain and diluent; during this period staining takes place.

F. Wash the smear gently with water until all traces of liquid stain are gone.

G. Blot with filter paper and permit it to dry in air.

H. Mount cover slip smear on a glass slide, film side down, with Canada balsam or other permanent mounting agent. Mineral or immersion oil may be used for temporary preparations.

4 Examination

A. Qualitative appraisal. A good smear should have at least 8 low power fields in which the red cells just touch but do not overlap. Suitable areas are examined systematically under oil immersion, a routine procedure being followed in which appearance of red cells, white cells, and platelets is described. In cover slip preparations, if the concentration of platelets is diminished or

number of nucleated red blood cells per 100 white blood cells as determined on examination of the stained smear

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$$\text{Nucl d cells/mm} \times \frac{\text{Nucl d RBC/100 WBC}}{100+\text{nucl d RBC/100 WBC}}$$

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if they are not present on 1 cover slip the mate should be examined

B DIFFERENTIAL NUCLEATED CELL COUNT The smear is scanned in a systematic manner using the oil immersion lens and the total number of each type of white blood cell present in 200 leukocytes is determined Nucleated red blood cells are counted in addition to the 200 leukocytes and their absolute number per cu mm is later calculated as described on page 120 (5 I)

ESTIMATION OF SICKLE CELLS

1 Principle

If type S hemoglobin forms more than 10 to 20% of the hemoglobin present in the red cells the physical alteration it undergoes when it is in a reduced (unoxygenated) state produces distortion of the film membrane so that the cells appear crescentic elongated or sickle shaped

2 Technique

A Place 1 drop of blood and 2 drops of fresh 2% sodium bisulfite solution on a clean slide and mix by gentle rotation for about 15 seconds (The sodium bisulfite solution will remain active for 1 week if kept stoppered and refrigerated)

B Drop a cover slip over the mixture press down gently to make a thin film and seal edges with petroleum jelly to prevent drying

C Allow to stand 30 minutes at room temperature and examine for sickle cells Report as positive if more than 10% of the cells are sickled

THE RETICULOCYTE COUNT

1 Principle

Ribonucleic acid present in immature red blood cells (giving a polychromatophilic appearance in Wright s stained smears) is precipitated into a blue reticulum with certain dyes when mixed with wet blood

2 Technique

A METHOD OF BRECHER Draw approximately equal por

tions of blood and reticulocyte diluting fluid (*new* methylene blue C I 927 0 5 Gm potassium oxalate 1 6 Gm distilled water to 100 ml) into a hemoglobin pipette expel mix and refill the pipette with the mixture Allow to stand 8 to 10 minutes blow out 2 to 3 drops on the end of the glass slide make smear and allow to dry

B WET METHOD Reticulocytes may also be identified and enumerated in a wet preparation stained with brilliant cresyl blue as described under platelet counting below

C With the oil immersion lens count the number of reticulocytes in 1 000 red blood cells Express results as reticulocytes per 100 RBC

D Do a red blood cell count

E Multiply the number of red cells per cu mm by the percentage of reticulocytes and report as reticulocytes per cu mm

THE PLATELET COUNT

1 Direct Methods

Blood is diluted in a red cell pipette with a freshly filtered solution of special platelet diluting fluids Platelets are counted directly in the counting chamber by direct or phase microscopy

2 Indirect Method (modified Dameshek Technique)

A Place 1 drop of fresh blood and 2 drops of brilliant cresyl blue solution (1 Gm. brilliant cresyl blue 0 85 Gm sodium chloride and 0 4 Gm solution citrate made up to 100 ml with distilled water) on a clean glass slide and mix by gentle rotation for about 15 seconds

B Drop a cover slip over the mixture press gently to make a thin film seal the edges with petroleum jelly

C Allow to stand 5 to 10 minutes

D With the oil immersion lens count the number of platelets per 500 red blood cells Express results in platelets per 100 red blood cells

E Do a red blood cell count

if they are not present on 1 cover slip the mate should be examined

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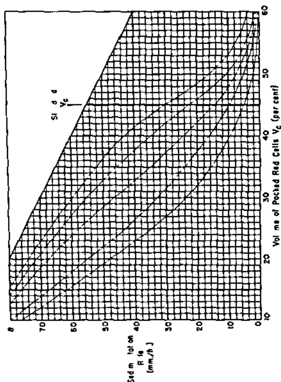
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2 Technique

A METHOD OF BRECHER Draw approximately equal por

6 On the Hynes Whitby modification of the Wintrobe Lands berg correction graph locate the junction of the columns of *Observed Sedimentation Rate* and *Volume of Packed Red Cells* This figure is the *Corrected Sedimentation Rate* representing that which would be observed if the subject s volume of packed red cells were 45%

7 In view of the disputed validity of the foregoing correction of sedimentation rate report each observation that was made
   (1) The observed sedimentation rate
   (2) The volume of packed red cells
   (3) The corrected sedimentation rate



F Multiply the number of red blood cells per cu mm by the number of platelets per 100 red cells and report the product as platelets per cu mm of blood

3 Critique

Platelet counting methods have a much larger inherent error than erythrocyte or leukocyte counting methods and are useful only in experienced hands For most clinical purposes sufficient information can be obtained by examination of a stained smear If platelets can be found without difficulty they are not significantly reduced in number and can be reported as decreased apparently normal or increased In addition a clot can be observed for retraction if retraction occurs platelets may be assumed to be present in adequate numbers

ERYTHROCYTE SEDIMENTATION RATE—WINTROBE LANDSBERG TECHNIQUE

1 Remove blood from a vessel without such difficulty as might lead to partial clotting or hemolysis Transfer the appropriate quantity at once to a bottle containing Sequestrene sodium Mix promptly

A If sickle cells are present they will retard the sedimentation rate and therefore should be converted to nonsickled forms through complete oxygenation of the hemoglobin This is accomplished by running a stream of oxygen from a cylinder into a bottle quickly corking and slowly rotating the bottle around its longitudinal axis for 5 to 10 minutes until the blood is bright red

2 *Within 90 minutes* of the removal of blood fill a Wintrobe hematocrit as described for the determination of volume of packed red cells Note the exact time (0 time)

3 Place the hematocrit in a special rack in an exactly vertical position (even imperceptible deviation from the vertical will allow more rapid sedimentation)

4 At the end of precisely 1 hour note the millimeters of settling of the topmost red cell layer (read from the top of the tube) This is the *Observed Sedimentation Rate*

5 Centrifuge the hematocrit as described to determine the *Volume of Packed Red Cells (Vc)* in millimeters (Read from the bottom of the tube)

B Pour off serum and break up the clot by forcing it through a wire screen into a small beaker
C Transfer the disrupted clot to a test tube and concentrate leukocytes by centrifugation
D Make smears of the buffy coat layer and stain with Wright s stain
E Examine with the oil immersion lens of the microscope The L E cells appear to be neutrophils in which the nucleus is pushed to one side and the cytoplasm is filled with a reddish brown or purple homogeneous mass

TESTS FOR ABNORMAL SERUM PROTEINS

1 Cryoglobulins

A PRINCIPLE Abnormal proteins which precipitate at low temperatures (5 to 30 C) are occasionally found in patients with multiple myeloma and rarely with chronic lymphocytic leukemia and certain other conditions They may be associated with Raynaud s phenomena
B TECHNIQUE With the patient fasting draw approximately 10 ml of blood and allow to clot keeping it at 37 C Centrifuge remove the serum and place in a test tube in the refrigerator (5 C) Examine in 30 minutes for precipitate If none is seen keep in the refrigerator up to 6 days
If a precipitate should form remove the tube from the refrigerator and rewarm to 37 C True cryoglobulins will redissolve precipitated fibrin will not

2 *Macroglobulins (Sia Water Test)*

A PRINCIPLE In some patients with hyperglobulinemia a precipitate forms on addition of a drop of serum to distilled water Macroglobulins settle rapidly to the bottom Such a finding suggests the diagnosis of macroglobulinemia of Waldenstrom but other studies are required for its proof A negative result does not disprove the diagnosis
B TECHNIQUE To an approximately 10 in column of distilled water (in a graduated cylinder or large test

QUALITATIVE TEST FOR OSMOTIC FRAGILITY OF RED BLOOD CELLS

1 Principle

The red blood cells of subjects with microspherocytosis are more susceptible to bursting through imbibition of water in hypotonic saline solution than are normal red blood cells

2 Technique (Screening Test)

A Prepare 1 bottle containing Sequestrene sodium with blood from the subject to be tested and 1 with blood from a normal person Exercise particular care to avoid hemolysis (e g avoid wet syringes)

B Place 0 1 ml of blood from the test subject in each of a pair of test tubes and the same amount of control blood in each of another pair

C Add 1 ml of 0 85% sodium chloride solution to 1 tube of each of a pair of test tubes and the same amount of control blood in each of another pair

D Mix each tube thoroughly and centrifuge all 4 The presence of hemoglobin in the supernatant of the 0 50% saline tube of the test subject probably indicates increased osmotic fragility The supernatant of the other 3 tubes should be colorless

E If the result is positive a more elaborate test determining the amount of hemolysis at varying concentrations of saline before and after incubation is necessary

TEST FOR L E PHENOMENON

1 Principle

In patients with disseminated lupus erythematosus a globulin is often present which when brought into contact with leukocytes causes lysis of nuclear material and subsequent phagocytosis by other cells

2 Technique

A Remove 5 ml of blood from a large vessel transfer to a test tube allow to clot and incubate for 2 hours

2 Bleeding Time

A Place a blood pressure cuff around the upper arm and inflate to 40 mm Hg

B With a lancet make a puncture wound approximately 2 mm deep in an avascular area on the anterior aspect of the forearm (Ivy method) or in a finger tip (Duke method) If the patient may have a hemorrhagic di athe is do not use an ear lobe

C Touch the escaping blood with a piece of filter paper every 30 seconds taking care not to touch or massage th wound

D When blood stops oozing from the wound report the time elapsed from the time puncture was made to the nearest half minute

E If blood fails to stop oozing after 15 minutes di con tinue and report the time as greater than 15 minutes

3 Detection of Capillary Fragility (Tourniquet Test Rumpel Leede Phenomenon)

A Note the presence on the hand and forearm of petechiae nevi, hemangiomata or other marks which might subse quently be confused with fresh petechiae

B Place a blood pressure cuff on the upper arm and in flate to 70 80 mm Hg or just at or below diastolic pressure Allow to remain 7 minutes

C Remove the cuff and wait 5 minutes

D Examine the forearm particularly the wrist and back of the hand for petechiae which have appeared pete chiae may normally appear just below the cuff Describe the appearance and distribution of petechiae and record their occurrence as rare or numerous

E Re examine and describe the findings after 30 minutes to 1 hour

PROTHROMBIN TIME

1 Critique of Method

Although the determination of prothrombin time" does not measure prothrombin concentration it affords a good

tube) add 1 drop of serum Observe whether any cloudiness or flocculation occurs and whether it remains suspended or falls promptly to the bottom Describe the result

EXAMINATIONS CONCERNED WITH HEMOSTASIS

1 Coagulation Time and Observation of Clot Retraction and Fibrinolytic Activity

A COAGULATION TIME (MODIFIED LEE WHITE METHOD)

1) Perform a venipuncture with a sterile 5 ml syringe and needle Note the time when blood first enters the syringe (0 time)
2) Draw 5 ml of blood remove needle and gently expel 1 ml into each of 2 clean *13 × 100 mm* test tubes which have been rinsed with saline
3) Place the tubes in a rack at room temperature and tilt 1 of the tubes at 30 second intervals until it can be inverted without spilling blood
4) Now continue the same procedure with the other tube until the same end point is reached Coagulation time is the difference in minutes between the time the blood enters the syringe and the time the second tube can be inverted without spilling

B OBSERVATION OF CLOT RETRACTION

1) After Step 4 has been completed separate the clot in 1 of the tubes from the glass by gently rimming with an applicator stick
2) Observe the tube at hourly intervals to detect contraction in the size of the clot with expression of serum
3) *The time in hours for beginning clot retraction is* noted. The ability of the clot to retract is almost entirely dependent on the presence of adequate platelets

C OBSERVATION OF FIBRINOLYTIC ACTIVITY

1) Following Step 4 observe the undisturbed tube for dissolution of the clot at *30* and *60* minutes and 2 3 4 and 24 hours

lignancy Gaucher's disease certain megaloblastic anemias and aleukemic leukemia

B For investigation of anemia leukopenia and thrombocytopenia of unknown cause

C For culture

D For estimation of tissue iron stores

2 Limitations

A It is of little or no value in most common forms of anemia hemolytic disease polycythemia chronic leukemias and lymphoma and in patients whose illnesses have not been clarified by other diagnostic procedures but who lack the indications noted above

B It does not provide reliable information about cellularity or architecture since dilution of the sample to an unknown degree with blood is inevitable Therefore hypoplastic anemia myelofibrosis marrow hyperplasia etc. cannot be diagnosed by this method histologic examination of surgically removed marrow is required

3 Site of Aspiration

A STERNUM Gives highest percentage of satisfactory samples in adults but has some psychologic disadvantage in apprehensive patients Penetration of sternum can result in serious or fatal injury Aspiration should be done in the midline of the manubrium below the angle of Louis (junction of second rib) not below the junction of the third rib

B ILIUM Does not have psychologic disadvantage or danger and is only slightly less likely to yield a satisfactory sample than sternal aspiration To aspirate the *anterior ilium* use a Turkel or similar marrow needle with the patient supine enter the marrow cavity 1 to 2 cm below the crest and 2 to 5 cm behind the anterior superior supine with the needle pointing medially and slightly cephalad Penetration of the fascia lata is felt before the bone is reached

The *posterior ilium* contains a larger marrow cavity and satisfactory marrow samples in larger volume may

means of evaluating the coagulability of blood when prothrombin is reduced as in patients with liver disease or under therapy with bishydroxycoumarin Results are reported as clotting time in seconds and as percent The latter is an abstract concept of little usefulness Clotting time is valid only when the control prothrombin time is normal in these circumstances a prothrombin time of 22 32 seconds is sought in patients receiving bishydroxycoumarin

2 Technique

A Under precautions that no alcohol enter the needle make a clean puncture of a large vessel and draw at least 4 5 ml of blood into a syringe

B Without delay introduce blood to exactly the 5 ml mark into a specially prepared marked stoppered centrifuge tube containing 0 5 ml of 0 1 M sodium oxalate Mix the contents of the tube promptly by inversion

C Add 0 1 ml of brain thromboplastin suspension allow to incubate at 37 C for a few seconds and then add 0 1 ml of 0 02 M CaCl simultaneously starting a stop watch The clotting times of the test and control plasmas are reported

3 Interpretation

The 1 stage prothrombin time will be prolonged in deficiencies of any of the following factors Prothrombin Factor V Stuart SPCA or Hageman Differences in prothrombin times are of greatest significance in the 15 35 second range differences between 2 very long or 2 very short times have less significance

BONE MARROW ASPIRATION

1 Indications

A For diagnosis of hematologic disorders by study of cell morphology when diagnostic cells are not ordinarily found in blood e g multiple myeloma metastatic ma

tissue for histologic section or for centrifugation to obtain buffy coat smears

On aspiration of the sternal marrow cavity a severe aching pain is felt by most patients and is a good sign that the needle is properly placed This symptom is less frequently observed on aspiration at other sites

The needle is then withdrawn and a small sterile dressing is applied to the puncture site If little or no material could be obtained on aspiration any material in the lumen of the needle should be expressed with the stilet and smears made

5 Examination of Smears

A. Smears are stained with Wright s stain or special stains for certain purposes (e g Prussian blue for stainable iron) Cellular preparations may require longer times for fixing and staining with Wright s stain than blood smears but are otherwise handled in a similar fashion

B Examine smears first under low power (*a*) to find suitable areas for examination with oil immersion objective (*b*) to locate megakaryocytes and other large cells or nests of malignant cells

C With the oil immersion objective detailed morphology of abnormal cells may be studied. A differential count and myeloid erythroid (M E) ratio may be estimated counting 300 to 500 consecutive cells Normal values for these are given in the table which follows

OTHER STUDIES

Such studies as determination of serum iron or clotting factors not described above, hemoglobin electrophoresis etc usually are carried out after arrangement with the Hematology or Coagulation Laboratory

AVERAGE NORMAL HEMATOLOGIC AND BONE MARROW VALUES

Th following tables indicate the range of average normal values in different age groups

also be obtained from this site A Vim Silverman or a similar needle is commonly used in this site

C SPINOUS PROCESS OF LUMBAR VERTEBRA May be used with the patient sitting or prone entry is made directly into the end of the process in the midline

D TIBIA Satisfactory in small children or infants after 4 5 years of age the cortex becomes too thick and cel lular marrow is not regularly found at this site Entry is made just below the tubercle anteriorly or medially

4 Technique

The site selected should be prepared and draped as for a *surgical procedure The operator should scrub and wear* sterile gloves The skin subcutaneous tissue and periosteum should be infiltrated with procaine A small (⅛ in) incision in the skin facilitates penetration of the needle

A commonly used needle is the Turkel which consists of an outer short needle with its stilet and a longer inner needle with a saw toothed tip and its stilet This needle is satisfactory for the sternum anterior iliac crest spinous process or tibia Longer needles of different design may be helpful in iliac crest punctures in obese patients but are likely to produce greater dilution of the sample

The outer Turkel (or other needle) with stilet in place is pushed to the periosteum and then through the cortex with a rotating boring motion A give is usually felt as the sternal marrow cavity is entered this is less fre quently noted at other sites The inner saw toothed Turkel needle may be used to facilitate penetration of the cortex or to obtain a piece of marrow tissue for histologic section or imprints

After the marrow cavity is entered the stilet is removed and a sterile 5 ml syringe attached to the needle Gentle but firm suction is then applied until the first drop of marrow blood appears At this point the syringe is removed and passed to an assistant who prepares smears A second syringe moistened with heparin is then attached and up to 1 ml of material is aspirated from the marrow cavity this may be used to culture to obtain particles of marrow

Average Normal Hematologic Values (*cont.*)

3 *Platelets*

	Direct Method	Indirect Method
Platelet count (thousands/cu. mm.)	300 ± 150	600 ± 300

4 *Bleeding and Clotting Factors*	
Coagulation time (minutes)	10 ± 5
Clot retraction	Present by 1 hour
Bleeding time (minutes)	3 ± 2
Capillary fragility	No petechiae on wrist or hand
Prothrombin time (seconds) (Quick 1 stage plasma clotting time)	13 ± 1
Prothrombin utilization	<20% residual at 1 hour
Plasma fibrinogen (Gm./100 cc.)	300 ± 100
Fibrinolysis	None in 24 hours
Partial thromboplastin time (seconds)	60–90
5 *Miscellaneous*	
Corrected sedimentation rate (mm./hr.) (Vc = 15%)	<10
Serum iron (micrograms/100 cc.)	125 ± 75
Total iron binding capacity (micrograms/100 cc.)	350 ± 150

Average Normal Hematologic Values

1 *Red Blood Cells*

	Birth	3 Mo	6 Mo – 1 Yr	4 Yr *	Adult M	Adult F
Volume of packed red cells (%)	54	36	35 5	37	47 ± 7 0	42 ± 5 0
Hemoglobin (Gm /100 cc)	17 6	11 4	11 8	13 1	15 ± 3 0	13 ± 2 5
Fetal Hgb (% of total)	70 ± 15	25 ± 15	3 (1 25)	<2	<2	
Erythrocyte count (millions/cu mm)	5 1	4 3	4 6	4 6	5 ? ± 0 8	4 8 ± 0 6
Reticulocytes (thousands/cu mm)	100	20	40	50	50 ± 25	
Nucleated RBC (thousands/cu mm)	2 ± 1	0	0	0	0	
MCV (cu microns)	106	80	77	80	88 ± 6	
MCHC (%)	36	34	33	34	33 ± 3	
MCH (micromicrograms)	38	27	26	27	29 ± 2	
Osmotic fragility		No hemolysis in 0 50% sodium chloride solution				

2 *White Blood Cells*

	Birth	2 Da	2 Wk	3 Mo	4 Yr *	Adult
Leukocyte count (per cu mm)	15 000	21 000	11 000	9 500	8 000	7 500 ± 3 000
Metamyelocytes (juveniles and bands)		1 000				300 ± 150
Segmented neutrophils	6 500	12 000	4 000	3 500	4 000	4 500 ± 1 500
Eosinophils	500	500	400			250 ± 150
Basophils		60	60	60		30 ± 15
Lymphocytes†	4 500	4 500	6 000	5 000	3 000	2 100 ± 700
Monocytes	2 000	3 000	800	600	600	400 ± 200
Immature leukocytes	1 500	1 000	100	0	0	0

* [illegible]
† [illegible]

2 Urine

ROUTINE OR BASIC EXAMINATION

1 Appearance

Color and degree of turbidity are recorded

2 The pH

This is determined with nitrazine paper For the determination to be meaningful the specimen must be fresh because the pH rises as urine stands

3 Specific Gravity

The urinometer should be read at the level of the bottom of the meniscus the accuracy of the instrument should be checked with water first

4 Protein

A HEAT AND ACETIC ACID TEST If the specimen is cloudy it is preferable to use the supernatant fluid after centrifugation Fill a test tube two thirds full of urine Holding the test tube by the bottom rotate the upper end in an open flame thus bringing the upper layer of urine to a boil Add 3 drops of 5% acetic acid and reheat The persistence of a cloudy precipitate after the addition of acid indicates the presence of protein

An alkaline urine may give a cloud on heating due to the precipitation of phosphates but this will dissolve on addition of acid An excessive amount of acid also may redissolve the albumin The appearance of a cloud which fades on further heating is suggestive of Bence Jones protein

Average Normal Bone Marrow Values

	Normal %
Reticulum cells	0 2 — 2 0
Blasts	0 8 — 5 8
Promyelocytes	1 0 — 8 0
Myelocytes—neutrophils	5 0 — 19 0
eosinophils	0 5 — 3 5
basophils	0 1 0
Metamyelocytes—neutrophils, eosinophils, basophils	13 0 — 32 0
P M N —neutrophils	7 0 — 30 0
eosinophils	0 5 — 4 0
basophils	0 — 0 7
Lymphocytes	3 0 — 20 0
Plasma cells	0 — 2 0
Monocytes	0 5 — 5 0
Megakaryocytes	0 03 — 3 0
Mitotic cells	0 — 2 0
Pronormoblasts	1 0 — 8 0
Normoblasts—basophilic, polychromatophilic, orthochromatic	7 0 — 32 0
Myeloid—erythroid ratio	2 1 — 5 1

orange or red due to the appearance of a finely dispersed yellow or red precipitate which settles on standing The amount of sediment is directly related to the concentration of reducing substance present

Benedict s reagent is reduced by glucose and by a number of other substances occasionally found in urine such as galactose levulose, pentose glycuronates and salicylates In appropriate cases further steps should be taken to identify the reducing substance

Record results in a roughly quantitative estimate as follows

Bluish green	1+
Pea green	2+
Yellow	3+
Orange	4+
Red with colorless supernatant	C R. (complete reduction)

B CLINITEST METHOD (CLINITEST TABLETS—AMES) Place 5 drops of urine in a test tube Add 10 drops of water and 1 Clinitest tablet Wait 15 seconds after spontaneous boiling has ceased and compare solution with color scale Record as 0 to 4+

These tablets react in the same way to the same reducing substances as does Benedict s solution

C GLUCOSE OXIDASE PAPER (TES TAPE—LILLY OR CLINISTIX—AMES) A small strip of the paper is dipped into the urine specimen and read by comparison with the provided color chart Tes Tape is read 1 minute after dipping Clinistix is read immediately

This test is specific for glucose A good routine plan is to use the nonspecific test for reducing agents on all specimens then when positive results are obtained, the reducing substance may be further identified by the use of glucose oxidase paper

6 Microscopic Examination

A 10 ml specimen of urine should be centrifuged at 2500 rpm for 5 minutes within 30 minutes after collection The supernatant is then discarded the sediment resuspended by agitation transferred to a clean glass slide and covered

Record a roughly quantitative estimate as follows

Faint cloud visible only against black background	1+
Easily visible cloud	2+
Opaque cloud	*3+*
Dense cloud with flocculent precipitate or boils solid	4+

B SULFOSALICYLIC ACID METHODS To 2.5 ml of urine in a test tube add 7.5 ml of 20% sulfosalicylic acid The resulting degree of turbidity is graded 1+ to 4+

C BENCE JONES PROTEIN

1) *Principle* in some patients with multiple myeloma (rarely in other conditions) a protein appears in the urine which is insoluble at 45 C—60 C but dissolves at higher and lower temperatures

2) *Technique*

a) Place about 10 ml of slightly acid clear urine in a large pyrex test tube Acidify with dilute acetic acid if necessary Filter if cloudy

b) With a thermometer in the tube place in a large beaker of water and heat slowly observing the temperature at which any precipitate appears or disappears

c) Finally boil the urine if precipitate persists after 2 minutes of boiling filter while hot (near boiling) to remove albumin

d) Observe appearance of any precipitate during cooling Repeat Step *b* if albumin was present

e) If no protein is present on the sulfosalicylic acid test Bence Jones proteinuria will be absent If Bence Jones protein is found confirmation by electrophoresis is desirable

5 Sugar

A BENEDICT'S METHOD To 5 ml of Benedict's solution add 8 drops of urine and mix Heat for 5 minutes in boiling water or (less satisfactorily) boil for 1 minute over an open flame Allow the tube to cool

The presence of reducing substance is indicated by a change in the color of the solution to green yellow

3 Urobilinogen (Wallace and Diamond Method)

Six to 10 clean test tubes of the same internal diameter are placed in a test tube rack for serial dilution of the fresh urine sample If the urine contains bile in large amounts the supernatant from the Harrison Spot Test, (above) may be used the bilirubin having thus been precipitated out In this event it should be remembered that the first specimen is already diluted 1 2

Five ml of tap water is placed in all but the first test tube Then 5 ml of urine is pipetted into the first 2 test tubes The urine and water in the second tube are mixed and 5 ml pipetted into the third tube This procedure is carried out serially through the final tube from which 5 ml is removed and kept for further dilution if required For the Wallace and Diamond method 0.5 ml Ehrlich s reagent is then added to each tube and mixed The tubes are allowed to stand for 5 minutes and then read by looking vertically down the tube through the solution at a white background in bright daylight. The end point is recorded as the last dilution in which a faint pink color appears

In fresh normal urine a pink color may be detected at dilutions of 1 8 to 1 32 A pink color noted in a dilution of 1 64 or greater represents increased urinary excretion of urobilinogen The absence of a pink color in dilutions of 1 8 or below indicates decreased excretion

4 Porphobilinogen

A. METHOD Place a few ml of freshly passed urine in a test tube Add an equal volume of Ehrlich s reagent and mix Now add 2 volumes of aqueous saturated sodium acetate The development of a red color implies the formation of either urobilinogen aldehyde or porphobilinogen aldehyde (or both) Urobilinogen aldehyde is soluble in chloroform but porphobilinogen aldehyde is not Hence, they can be separated as follows Shake a few ml. of the red solution in a test tube (or separatory funnel) with some chloroform If after settling the aqueous layer still contains red color this layer must be repeatedly separated and reshaken with fresh volumes of chl roform until either the aqueous or

with a cover slip Valuable data may be obtained from study of the sediment Repeat examinations often are helpful The formed elements should be roughly quantitated in terms of the number of each type seen per high power field To be noted are white blood cells (clumping should be noted) red blood cells casts epithelial cells crystals and bacteria The size and appearance of casts should be carefully characterized and reported Casts should be searched for under the low power of the microscope with the light intensity cut down The value of sediment study depends on the freshness of the specimen the manner in which it is collected, and the diligence with which it is examined

SPECIAL CHEMICAL TESTS

1 Acetone

To 5 ml of urine add 0 5 ml glacial acetic acid and 0.5 ml aqueous solution of sodium nitroprusside and mix Overlay the mixture with 2 ml concentrated ammonium hydroxide. A purplish ring at the zone of contact indicates a positive reaction The intensity of the reaction should be graded 1+ to 4+ Acetest (Ames) tablets provide a simple satisfactory modification of the nitroprusside test The test for acetone is routine in children

2 Bilirubin

A FOAM When a urine sample is shaken vigorously in a test tube foaming is produced In urine that does not contain bilirubin the olor of the foam is white or pale straw color A yellow green or brown color of the *foam* is presumptive evidence of the presence of bilirubin

B HARRISON SPOT TEST Five ml of urine is added to 5 ml of 10% aqueous barium chloride mixed and filtered The filter paper containing the precipitated material is spread on an evaporating dish Petri dish or another piece of filter paper and › 3 drops of Fouchet s reagent is added to the precipitate The development of a green color indicates the presence of bilirubin, and its intensity may be crudely graded from 1+ to 4+

presence of phenylpyruvic acid This test may be used in screening patients for phenylpyruvic oligophrenia.

6 Calcium

The *Sulkowitch test* is used to gauge in a gross fashion the amount of calcium in the urine The Sulkowitch solution is

Oxalic acid	2 5 Gm
Ammonium oxalate	2.5 Gm
Glacial acetic acid	5 0 ml
Distilled wat r to	150 0 ml

Place 5 ml of urine in a test tube and add 5 ml of Sulkowitch solution The intensity of the precipitate and the speed with which it appears are used to quantify the reaction from 0 to 4+ The value of this test is limited by the fact that the intensity of the precipitate is a function of the volume of urine flow as well as the quantity of calcium excreted

KIDNEY FUNCTION TESTS

1 Phenolsulfonphthalein Test (PSP)

A. Method

1) Give the patient 3 or 4 glasses of water in the course of 30 to 45 minutes Have him refrain from emptying his bladder
2) Ask him to notify you when he thinks his bladder is getting full but before he is uncomfortable At this point —
3) Inject exactly 1 0 ml of sterile PSP solution (6 0 mg) intravenously
4) Collect urine exactly 15 minutes and at 2 hours after the dye is injected Tell the patient to empty his bladder as completely as possible and make sure that all the urine is collected Include any urine passed between the 15 minute and 2 hour specimens as part of the 2 hour specimen
5) Record the volumes of both specimens and measure their content of PSP as follows

   a) Transfer the specimen to a 1 000-ml cylinder and alkalinize with sufficient concentrated sodium

the chloroform (bottom) layer remains entirely colorless. If a distinct (usually rather intense) red color persists in the aqueous phase while the chloroform remains colorless, the result is considered positive for porphobilinogen.*

B. INTERPRETATION. A positive result is almost pathognomonic of acute porphyria. Exceptions are: (1) very rare porphobilinogenuria in other conditions; (2) a faint pink or orange-pink color (chloroform insoluble but not due to porphobilinogen aldehyde) when the original urine contains large amounts of urobilinogen; (3) a similar faint chloroform insoluble color of unknown cause in various other conditions. The last 2 sources of confusion often can be eliminated if the original urine is diluted 1:5 before the test (true porphobilinogenuria will still be demonstrable).

5. Salicylates, Ketones, and Phenylpyruvic Acid

To 5 ml. of urine in a test tube add 5 to 10 drops of 10% ferric chloride solution drop by drop with agitation of the test tube until the initial precipitate of ferric phosphate redissolves.

A. SALICYLATES AND KETONES. The development of a dark Burgundy red color indicates the presence of salicylates or ketones. To distinguish the two, acidify 5 ml. of urine with several drops of strong acid (HCl), boil vigorously for a few minutes and cool. Then repeat the ferric chloride test on this sample. Persistence of the red purple color indicates the presence of a nonvolatile compound producing the color and is presumptive evidence of the presence of salicylates. Certain metabolites of coal tar dyes will also cause a positive reaction. Salicylate does not react in the nitroprusside test for urinary ketones.

B. PHENYLPYRUVIC ACID. The development of a dark bluish green color in the acidified urine indicates the

* More specific identificat... quires d mon t at on ... pe trosc p c ab rpt on band maxim ... t 550-750 m ll m ... ro s f ... th ... hl ... f ... uble substan ... nd is ev n more con ... nc g if there is a sec ... d ry pe k at 5 0 5 5 m ll mi ron

ea e and in pregnant women although the dose used will not ordinarily produce a pressor or vasoconstrictor effect

For results to be m aningful accuracy of urinometers must be checked with water A normal person should be able to concentrate to 1 025

SPECIAL EXAMINATIONS INCLUDING BACTERIOLOGY

1 *Introduction*

Since certain of the abnormalities of the urine associated with urinary tract disease frequently are intermittent, it is often necessary to make repeated studies of the urine before important changes are observed Bacteria W B C R B C casts and protein may appear in significant amounts or numbers only intermittently in the urine during a 24 hour period For this reason when a patient is being studied initially for suspected urinary tract disease it is suggested that a careful plan be followed in examining the urine in addition to investigations of renal function and a search for obstructive lesions of the urinary tract Such a plan might include

1 Basic examination of random voided specimen × 3
2 Clean catch or catheterized urine specimen for culture daily × 3
3 10 ml of clotted blood for bacterial hemagglutination test × 2 with 7 day interval between specimens
4 A timed urine specimen for Addis count and quantitative protein determination × 2

Patients who might benefit from being examined in this manner would include

1 All patients suspected of having urinary tract infection
2 All patients with diastolic blood pressure of 100 mm of Hg or more
3 Patients with diabetes mellitus
4 Patients with decreased renal function or renal failure and anemia
5 Patients who have been subjected to urinary tract catheterization or instrumentation To detect infection initiated by these procedures the patient should be studied

hydroxide to bring out the maximal purplish red color

b) Dilute to 500 ml with tap water and mix well by stirring If the resulting color is deep dilute to 1 000 ml

c) Fill the empty vial of the PSP colorimeter set with the solution obtained in (*b*) and compare with standards If a dilution of 500 ml has been used divide the result by 2

B INTERPRETATION At a urine flow of at least 4 ml per minute the PSP excretion reflects (1) renal plasma flow, and (2) renal tubular function Normal values consist of greater than 25% excretion in 15 minutes and greater than 60% excretion in 2 hours A bladder residuum may be detected by additional collections if renal function is known to be normal

2 Urine Concentration Tests

A METHOD 1 Do not allow the patient any fluid or food after supper until completion of the test the following morning Discard the first morning urine Collect urine specimens at 1 and 2 hours after the first morning urine and measure the specific gravity of each

This procedure should be employed with circumspection if at all Patients with chronic renal disease may be made clinically worse by the superimposition of dehydration incident to this technique

B METHOD 2 Administer 1 unit of aqueous vasopressin (Pitressin) subcutaneously (preferably soon after the patient arises and before he voids) Considering this as zero time proceed according to the following schedule

TIME	PROCEDURE
0	1 unit aqueous vasopressin s c
15 min	Patient voids discard urine
105 min	Collect urine measure specific gravity Give another—1 unit dose of aqueous vasopressin s c
195 min	Collect urine measure specific gravity

The administration of vasopressin is unwise in patients with angina serious hypertension or vascular dis

a) Have the patient drink 4 glasses of water (or liquid) and wash the vulva with soap and water Instruct her to call the nurse when she feels an urgent desire to void
b) Have nurse obtain specimen as follows
    (1) Expose urethral meatus and clean with four 2×2 in gauze squares using single downward strokes as follows (a) Use a dry gauze square for a single midline downward stroke (*b*) Use a square moistened with pHisohex for each side (*c*) Use a square moistened with pHisohex for a single midline downward stroke
    (2) Pour 100 ml (approx) sterile saline over the meatus to rinse off the pHisohex Do not allow labia to close
    (3) Instruct the patient to void Catch a midstream urine specimen in a sterile urine bottle Do not contaminate the bottle mouth by holding it against the patient s vulva

In the male Clean-catch specimens are satisfactory for culture if carefully taken by or under the direct supervision of a *house officer* After thorough cleansing of the glans and urethral meatus with *pHisohex followed by sterile saline* the patient should be instructed to void and a midstream specimen should be passed into a sterile urine bottle Cap with a *sterile* top and label Clean Catch Specimen The specimen should be sent immediately to the laboratory If the patient is unable to cooperate a catheterized specimen will usually be necessary

2) *Catheterized specimen—*
In patients with indwelling catheters urine specimens should be obtained by disconnecting the catheter from the adapter discarding the urine that drains easily from the catheter and waiting for fresh urine to flow out the catheter This should be collected in a sterile urine bottle, capped with a sterile cap and sent immediately to the laboratory

3) *Cystoscopy—*
Urine obtained by urologists at cystoscopy should

at 3 days and at 10 days after the procedure as well as before the procedure if possible

The chronic recurrent nature of urinary tract infection requires that careful follow up studies be carried out on patients treated for this disorder

2 Collection of Urine for Examination

A RANDOM VOIDED SPECIMEN FOR ROUTINE OR BASIC EXAMINATION The sample voided on arising in the morning is most satisfactory

In the adult female The voided urine is usually contaminated by vaginal secretions containing leukocytes and epithelial cells Menstrual blood may be introduced into the urine in large or small amounts Specimens from a female patient should be obtained by washing the vulva with soap and water and having her void directly into the specimen container avoiding contact of the urine with the vulva

In the male Specimens may be obtained by having the patient void directly into the specimen container

B TIMED SPECIMEN FOR ADDIS COUNT AND QUANTITATIVE PROTEIN DETERMINATION Use a 1 qt waxed paper carton in which 5 drops of formalin have been placed *If there is no contraindication to fluid restriction* instruct the patient as follows

1) *Take no fluid* of any sort after noon until the end of the collection period the following morning
2) Void and *discard* urine at *exactly* 10 P M
3) After that save all urine by voiding directly into the container until the end of the collection period
4) End collection at *exactly* 7 A M the following morning by voiding into the container
5) Save the entire specimen

C SPECIMEN FOR BACTERIOLOGIC STUDIES

1) *Procedures for obtaining clean catch urine specimen— In the female* Ask the Nursing Service to collect a clean catch specimen When questionable results are obtained on study of a clean catch specimen a catheterized specimen may be indicated This should be collected by careful aseptic techniques

a) Have the patient drink 4 glasses of water (or liquid) and wash the vulva with soap and water Instruct her to call the nurse when she feels an urgent desire to void

b) Have nurse obtain specimen as follows

   (1) Expose urethral meatus and clean with four 2×2 in gauze squares using single down ward strokes as follows (a) Use a dry gauze square for a single midline downward stroke (*b*) Use a square moistened with pHisohex for each side (*c*) Use a square moistened with pHisohex for a single mid line downward stroke

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3) *Cystoscopy—*

Urine obtained by urologists at cystoscopy should

be labeled as to source and sent directly to the laboratory

4) *Culture*—
All specimens should be cultured within 30 minutes after collection or they may be examined within 2 hours if refrigerated immediately after collection

3 Examination of Timed Urine Specimen

A ADDIS COUNT (QUANTITATIVE SEDIMENT EXAMINATION)

1) Measure urine collected over a known time period and centrifuge 1/5 hour volume at 1750 rpm for 5 minutes
2) Reduce volume at 0 5 ml and resuspend sediment in the remaining urine after adding 1 drop of crystal violet and safranin stain Transfer a drop to the hemocytometer chamber for count
3) Count cells in 3/5 of the area of 1 of the 9 large squares of the counting chamber and multiply by 1 000 000 to obtain the 24 hour excretion rate
4) Count casts in 6 of the 9 large squares of the counting chamber and multiply by 100 000 to obtain the 24 hour excretion rate

B QUANTITATIVE PROTEIN DETERMINATION An aliquot of supernatant from a 1/5 hour volume obtained in the Addis count is added to Tsuchiya s reagent (phosphotungstic acid in HCL and alcohol) and the volume of the resulting precipitate is measured after centrifugation and converted to Gm /24 hours

4 Routine Culture of Urine Flora

Specimens are inoculated on desoxycholate agar blood agar and trypticase soy broth to determine aerobic flora Anaerobic cultures are performed on special request

5 Gram Stain

Gram stain of urine sediment is important to determine the presence and Gram reaction of small numbers of organisms (for method see Microbiologic Examinations and Collec

tions p 169) The Gram stain will be positive on uncentrifuged urine if 10 or more organisms per ml are present

6 Count of Urine Bacterial Flora

One ml amounts of serial 10 fold dilutions of urine in peptone water are incorporated into poured trypticase soy agar plates After 24 hours incubation the plates are counted and the number of organisms per ml of urine is reported

7 Special serologic studies for antibodies (hemagglutinins) in the patient s serum against organisms isolated from urine

8 Cultures for *Mycobacterium tuberculosis* (see Microbiologic Examinations and Collections p 169)

3 Gastric and Duodenal Contents

METHOD OF COLLECTION

After 8 to 12 hours of fasting a rubber Levin tube is passed if possible through the nose to a point just inside the stomach The patient then moves from the sitting to the supine position and rolls over slightly to the left side Gastric contents may now be obtained by applying gentle suction with a syringe Vigorous suction should be avoided because it may cause gastric bleeding and often obstructs the tube by pulling mucosa into the fenestrations at the end of the tube

APPEARANCE

Gastric juice is normally viscid and white to pearly gray in color Minimal reflux of duodenal secretions will add the yellow color of bile Duodenal or gastric bleeding may cause the aspirated material to be red or to resemble coffee grounds The Benzidine Test (see Stool p 156) may be used to establish the presence of blood

GASTRIC ANALYSIS

The volume and acidity of gastric juice are measured during a 1 hour basal period 1 hour after stimulation with histamine insulin or broth and during a 12 hour overnight period Both histamine base 0 01 mg per kg given subcutaneously and regular insulin 15 units given intravenously provide maximal stimulation for gastric secretion in adults A 2 hour basal secretion determination appears to be a convenient more comfortable technique than the 12 hour aspiration It should be carefully standardized as to the time of day

Histamine should not be given to patients with a history of asthma or paroxysmal hypertension Hypoglycemia should be avoided in patients with coronary artery disease

1 Estimation of pH

A NITRAZINE PAPER may be used

B TOPFER S REAGENT Add 3 or 4 drops of Topfer s reagent to about 10 ml of gastric contents Approximate pH is indicated as follows

COLOR	PH
Red	3 0 or below
Salmon pink	3 3
Yellow	4 0 or above

2 Quantitative Titration of Gastric Acidity

If the gastric juice contains much food or saliva it should be strained through 3 or 4 layers of gauze Usually unstrained gastric juice is satisfactory Place 10 ml of gastric juice in a white dish and add 3 or 4 drops of Topfer s reagent Development of a red color indicates the presence of **free acid** To titrate add 0 1 N sodium hydroxide drop by drop from a burette or pipette stirring frequently until the mixture turns canary yellow The volume of alkali used is multiplied by 10 to give the milliequivalents of free hydrochloric acid per 100 ml of gastric juice To measure the **combined acid** present add 3 or 4 drops of phenolphthalein to the dish and continue titration with 0 1 N sodium hydroxide until the liquid remains pink on stirring Calculation for milliequivalents of combined acid is performed by the same formula as for free acid

The quantitative study of gastri secretion appears to have some clinical value in assessing to some degree the severity of hypersecretion when such exists

3 Tubeless Gastric Analysis (Diagnex Blue)

This is useful as a screening test in determination of the presence of free acid in the stomach The test is performed as follows

3 Gastric and Duodenal Contents

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The quantitative study of gastric secretion appears to have some clinical value in assessing to some degree the severity of hypersecretion when such exists

3 Tubeless Gastric Analysis (Diagnex Blue)

This is useful as a screening test in determination of the presence of free acid in the stomach The test is performed as follows

A The patient fasts overnight and omits breakfast
B On arising the patient empties the bladder and discards this urine
C Caffeine sodium benzoate 0.5 Gm is taken by mouth with 250 ml of water
D One (1) hour later the patient voids and saves this urine as a control specimen Then Azure A Resin granules 2 0 Gm are stirred in ¼ glass of water and drunk. Additional water may be necessary as the granules will not dissolve
E Two (2) hours after taking the granules the patient voids This specimen is the test urine
F Both specimens are diluted to 300 ml each with tap water and are read in a color comparator It may be necessary to acidify or heat the test urine to produce the blue color

Comment A color intensity of the test urine equal to or exceeding that of the 0 6 mg standard indicates free gastric hydrochloric acid A color intensity between the 0 3 and 0 6 mg standards is presumptive evidence of hypochlorhydria one of less than the 0 3 mg standard indicates achlorhydria A tube gastric analysis using histamine stimulation is indicated when free acid is not clearly present on the Diagnex test

SPECIMENS FOR CYTOLOGIC EXAMINATION

Secretions and saline washings from the stomach and duodenum may be examined for neoplastic cells It is *important* that the aspirated material be free from food and barium and that it be submitted to the Pathology Laboratory promptly Enzymes readily digest exfoliated cells and therefore saline washings are far superior to digestive juices for examination Digestion of cells may be slowed by placing the vessels containing the washings in a bowl of ice (see Specimens for the Cytology and Pathology Laboratories p 199)

MISCELLANEOUS TESTS OF GASTROINTESTINAL FUNCTION

1 Butter Fat Absorption Test

This is a simple rapid method of studying fat absorption in patients considered to have the malabsorption *syndrome*

Favorable correlation has been found with serum chylomicron counts as well as radioisotope labeled fat excretion studies The test is done as follows

A A breakfast meal of 30 0 Gm of butter 2 pieces of dry toast or 6 soda crackers 100 ml of fruit juice and 1 cup of coffee with sugar (no cream) is given the fasting patient

B One fasting and 5 hourly amples of clotted blood (6 8 ml blood in a dry clean tube) are collected

C During the test period the patient is kept in bed and is not allowed to eat or smoke

D The 6 blood samples are taken to the laboratory where turbidity of the serum is measured in a spectrophotometer

Normal Optical density (OD) above 0 100 from the second to the fourth hour is considered a normal lipemic response to the test meal

2 d (+) Xylose Tolerance Test

This is commonly used as a screening test in patients suspected of having the malabsorption syndrome It is performed as follows

A Give nothing by mouth after midnight on the day preceding the test

B When he arises have the patient void and discard the urine

C Dissolve 25 0 Gm of d (+) xylose in 250 ml of cool tap water and have the patient drink it Give an additional 250 ml of water 30 minutes later

D Allow no more food or liquid for the remainder of the test period

E Collect *all* urine for a period of 5 hours

F Send the 5 hour urine specimen to the laboratory for d (+) xylose determination

Comment Normal range 6 5 ± 1 2 Gm d (+) xylose excreted in 5 hours

Severe renal disease or improper collection of specimen (less than 5 hours or failure to have the patient void beforehand) will give a falsely low value Collection beyond 5 hours results in a falsely elevated value As glycosuria causes a

falsely high value indicate on the request slip if the patient is diabetic so that proper correction may be made

3 Secretin Test for Pancreatic Function

Have the patient fast overnight In the morning pass a double lumen tube (Einhorn) to a point just proximal to the ligament of Treitz under fluoroscopic control Then attach wall suction of 40 cm of water pressure to the duodenal and gastric sides of the Einhorn tube through a system of 2 collection bottles After a control period (20 minutes) of aspiration give secretin intravenously in the amount of 1 0 clinical unit per kg of body weight Four 20 minute collection periods are then completed and the volume and pH of each amount collected (duodenal and gastric) is measured and recorded At the end of each 20-minute period empty the collection bottles into a graduated cylinder and test with pH paper Place an aliquot (10 12 ml) of each of the duodenal aspirates in a dry clean test tube layer with mineral oil cork tightly and store in an ice bath or a refrigerator (The gastric specimens are discarded after measurement) Label the tubes with name date and time (20 minutes 40 minutes etc)

On completion of the test take the 5 duodenal specimens (control 20 40 60 80 minutes) to the laboratory for determination of bicarbonate and amylase If clinically indicated an appropriate volume of the duodenal aspirate may be sent to the Cytology Laboratory for examination for atypical or neoplastic cells

Interpretation A decrease in volume with normal bicarbonate and amylase concentrations is indicative of pancreatic duct obstruction A normal volume with a diminished bicarbonate and amylase response is indicative of chronic inflammatory disease of the pancreas

4 Screening Test for 5 Hydroxyindole Acetic Acid (5 HIAA) (Ehrlich s Aldehyde Method)

Mix equal parts of Ehrlich s aldehyde reagent and urine Let stand for 5 to 8 hours A dark blue color develops if positive This screening test will be positive if the urine

content of 5 HIAA is greater than 30 mg per liter of urine This test is *not* specific for 5 HIAA

A positive result of the screening test dictates that a nitrosonaphthol test be done by the laboratory The latter is qualitative and specific for 5 HIAA

4 Stool

COLLECTION

The patient may collect the specimen himself if supplied with tongue blades and a cardboard container The specimen may be collected by the physician at the time of rectal examination Liquid stools and those to be stored for more than a few hours should be collected directly in a wide mouthed screw topped glass jar

DESCRIPTION

Break open the stool if formed since exposure to air may change the outside color to dark brown or black Urobilin gives the normal stool a brown color but this may vary from light yellow in a milk fed infant to green when the diet is high *in green vegetables Gross hemorrhage produces maroon or* sticky black stools Bismuth iron charcoal licorice and altered blood commonly result in black stools carrots beets BSP and unchanged blood may produce a reddish hue Excess fat in the feces may impart a light gray and a silvery sheen that can conceal the presence of urobilin and blood In the absence of urobilin the light gray clay colored acholic stool develops The stool is bulky contains undigested food particles and has an offensive odor when there is a deficiency of pancreatic enzymes

TESTS FOR OCCULT BLOOD

Stools containing significant amounts of blood may have a normal appearance *Tests for blood are based on the development* of color when heme reacts with benzidine or gum guaiac

1 Benzidine Test

Smear a thin layer of stool over a 2 cm square of filter paper using a wooden applicator stick or the gloved finger

used for rectal examination Cover this area with 3 or 4 drops of benzidine dihydrochloride (not benzidine base) reagent Add the same amount of 0 6% aqueous hydrogen peroxide and mix the reagents The method is semiquantitative and color development should be observed at 1 minute and again at 5 minutes Maximal color development is recorded as gradations from delayed light green to prompt deep blue Stools from a person on a normal meat diet do not give positive reactions Iron and pus cells do not cause a positive reaction False positive reactions are encountered when the hydrogen peroxide is not fresh it should fizz when placed on the specimen

2 Guaiac Test

The test is performed in a manner similar to the Benzidine Test The reagents are added in the following order glacial acetic acid fresh gum guaiac solution 3 0% aqueous hydrogen peroxide Gradations of color from a slowly developing faint blue to an immediate deep blue are recorded The test is 2 or 3 times less sensitive than the Benzidine Test and may give a color reaction with iron A green color with the guaiac reagent is of no significance

MICROSCOPIC EXAMINATION

1 Ova and Parasites

Stool specimens should be examined while fresh Saline enemas may be useful in securing specimens The saline cathartics are preferable to castor oil mineral oil or cascara for this purpose since many cathartics interfere with the identification of parasites

Examination of a saline suspension of stool often permits identification of the commonly found ova and parasites

Instructions for sending specimens to the laboratory are given under Microbiologic Examinations and Collections page 169

2 Fat

A METHOD Mix thoroughly on a glass slide a thin film of fresh stool 3 or 4 drops of Sudan III or IV 1 drop of

normal saline and 2 or 3 drops of glacial acetic acid. Cover with a cover slip heat to boiling over an open flame and examine under low and high power magnification Count the number of fat droplets taking up the orange red dye

B INTERPRETATION

Normal—0 5 droplets per high power field

Slightly increased—6 or more droplets

Markedly increased—droplets of fat and fatty acid crystals occupy about half of the visible material

A normal result may be misleading in patients who are eating poorly and have scanty stools which may have a low total fat but a high fat concentration In patients with copious stools the concentration of fat may be normal despite a high total daily excretion

3 Muscle Fibers

The presence of meat (muscle) fibers alone may indicate only rapid intestinal transit If striations are distinct and the edge of the tissue is irregular rather than rounded, pancreatic tryptic enzyme deficiency is suggested

4 Blood and Pus Cells

Stain a smear of stool with Wright s stain (see Hematologic Procedures p 113) Diarrhea due to bacterial enteritis may be distinguished from that due to staphylococcal food poisoning by the presence of both red and white blood cells from ulcerations associated with the enteritis and their absence in food poisoning

TRYPSIN

A METHOD Dilute a freshly passed stool specimen collected without contamination by urine serially with water—1 5 1 10 1 20 etc Place 1 large drop (0 1 ml) of each well mixed suspension on unexposed unfixed Eastman x ray film and mark the dilution beside each spot Incubate the film at 37 C for 1 hour or at room temperature for 1½ to 2 hours After incubation, wash the film in a stream of cold

water with gentle rubbing dry and mount in the patient's record

B INTERPRETATION Complete clearing of the film is designated 4+ clearing only at periphery of the drop is 1+ A control with brown normal stool should be run with each test

Over 95% of normal infants and 68% of children aged 2 5 years will show tryptic activity in at least 1 5 dilution and often to very high dilutions Normal children over 10 and adults usually show no tryptic activity except with gastroenteritis or catharsis

In a young child negative tryptic activity (i e less than 1 5 dilution) suggests pancreatic fibrosis False positives may occur in such patients from contamination with urine from oral pancreatic supplement and from action of bacterial gelatinase (potentially present in stools which are not fresh)

DIFFERENTIATION BETWEEN FETAL AND ADULT HEMOGLOBIN IN BLOODY STOOLS OF THE NEWBORN

A PRINCIPLE Most of the hemoglobin in newborn infants is fetal and resistant to alkaline hydrolysis thus providing a means of differentiating it from swallowed maternal hemoglobin which is alkali sensitive

B TECHNIQUE Mix a small amount of grossly bloody (not tarry) stool with 5 to 10 parts of tap water in a test tube Centrifuge for 1 to 2 minutes at 1 000 or 2 000 rpm The supernatant must be distinctly pink if not, a more concentrated mixture of stool must be prepared Decant or filter the supernatant Add 1 cc of 0 25 N (1%) sodium hydroxide solution to approximately 5 ml of the hemoglobin solution and allow to stand for 2 minutes Note the color a solution containing fetal hemoglobin remains predominantly pink, whereas adult hemoglobin changes to brown yellow If the result is equivocal controls may be run using in place of the stool suspension, the infant's own blood and blood from an adult subject

BACTERIOLOGIC EXAMINATIONS

See Microbiologic Examinations and Collections page 169

5 Cerebrospinal Fluid

RECORDS

1 Record on the Laboratory Sheet the date source (site of puncture) initial pressure final pressure dynamics (if indicated) volume removed appearance clot WBC RBC differential count and Pandy test
2 Record in the Progress Notes the date of the procedure the site posture needle size and any difficulty encountered

PRESSURES

The initial cerebrospinal fluid pressure is the *lowest* pressure obtained with the manometer attached before any fluid has been withdrawn and after the patient has been relaxed as much as possible by decreasing the attitude of acute flexion and allaying apprehension and discomfort This may require a wait of as long as 5 minutes If good relaxation is still not obtained this should be carefully noted in the record Final pressure should be recorded when all the fluid required or obtainable has been withdrawn

DYNAMICS

In patients in whom diagnostic lumbar puncture is carried out, *an estimation of cerebrospinal fluid dynamics is in order only if there is reason to suspect spinal subarachnoid block and the intracranial pressure is not increased* Careful clinical judgment is required in the selection of patients for this procedure

QUANTITY OF FLUID REQUIRED FOR EXAMINATION

As a rule about 10 ml of fluid should be obtained and divided into 3 tubes as follows 2 ml in the first tube for cell count, differential Pandy test and qualitative sugar determi

nations 5 ml in the second tube for quantitative protein (and sugar if indicated) and 3 ml in the third tube for STS and colloidal gold If bacteriologic studies are desired consult Microbiologic Examinations and Collections page 169

The first 3 ml drawn has the highest and most nearly accurate total protein content. The last fluid withdrawn usually has the fewest cells of traumatic origin

GROSS EXAMINATION

The fluid should be characterized as to **color** and **turbidity** A similar tube containing water should always be used as a basis for comparison if there is any doubt about the color or if red blood cells are present for any reason

CYTOLOGY

The cell counts should be done at once and checked personally by the responsible physician Mildly traumatic taps are a source of considerable confusion in the interpretation of cell counts Crenation of the red cells if present should be carefully noted The presence of many red cells in the first tube and few in the third tube may also be of significance in this respect.

1 Total Cell Count

A Shake the fluid well and with a clean pipette transfer 1 drop to the hemocytometer chamber

B Count all the cells seen in the entire ruled area (9 large squares equal 0 9 cu. mm.)

C Multiply the result by 10/9 and report as cells per cu mm If the number is moderately high count the cells in the large central square only and multiply by 10

2 White Cell Count

A Draw glacial acetic acid up to the 0.3 mark in a white cell pipette

B Fill the pipette up to the 11 mark with spinal fluid and shake well

C Count all the cells seen in the entire ruled area of the

hemocytometer and multiply by 10/9 No correction is made for the small dilution factor

This method is used to hemolyze any erythrocytes from lymphocytes The red cell count is estimated from the difference between the total and the white cell counts

3 Differential Count

A Centrifuge spinal fluid at high speed for 10 minutes
B Decant the supernatant fluid and save for chemical tests
C Make a thin smear of the sediment on a clean slide and allow to dry in air
D Stain with Wright s stain (see Hematologic Procedures p 113) using great care to flood the slide gently with water as the smear is very easily washed off If the cells will not stick to the slide it may be necessary to suspend the sediment in a drop of egg albumin and fix with slight heating before staining

PROTEIN CONTENT

1 Pandy Test for Globulin

A Transfer 1 ml of Pandy s reagent (saturated solution of phenol in water) to a small test tube
B Add 1 *drop* of spinal fluid
C Observe the drop as it sinks in the reagent against a black background The appearance of a definite white halo around the drop of spinal fluid as it sinks in the reagent indicates the presence of an abnormally high globulin content The amount of globulin present should be graded 1+ to 4+ depending on the density of the cloud If more than 1 drop of spinal fluid is used many normal specimens will show a faint cloud The test is valueless in testing fluids containing blood

2 Quantitative Protein Determination

Five ml of spinal fluid should be sent to the Chemistry Laboratory when a quantitative protein determination is requested With this amount the sugar content can be determined if the cell count later is found to be increased The patient may thus be spared a second lumbar puncture

SUGAR CONTENT

1 Semiquantitative Method for Determination of Glucose

Measuring all amounts carefully with a 1 ml pipette calibrated to 1/100 introduce into each of 6 small test tubes 1 0 ml of Benedict s qualitative sugar reagent Layer the cerebrospinal fluid on top of the Benedict s solution with the calibrated 1 ml pipette putting 0 05 ml into the first tube 0 10 ml into the second 0 15 ml into the third 0 2 ml into the fourth and 0 25 ml into the fifth leaving the sixth tube as a control Immerse the 6 tubes in a gently boiling water bath for 10 minutes and allow to cool A cerebrospinal fluid sugar below the normal value of 35 mg /ml suggestive of the presence of living bacteria in the subarachnoid space is indicated by the absence of reduction in the tube containing 0 15 ml of cerebrospinal fluid See the table below for interpretation of the 6-tube test If this test is done carefully the results are reliable but it should not supplant the more quantitative analysis by the standard sugar method

CSF Sugar (mg %) by Benedict s Reduction (+)

CSF (ml.)	750	40–50	30–40	20–30	10-20	<10
0.00	0	0	0	0	0	0
0 05	+	0	0	0	0	0
0 10	+	+	0	0	0	0
0 15	+	+	+	0	0	0
0 20	+	+	+	+	0	0
0 25	+	+	+	+	+	0

2 Quantitative Sugar Determination

Send 1 ml of spinal fluid to the Chemistry Laboratory *together with a simultaneously drawn specimen of blood for blood sugar* If quantitative determinations of both protein and sugar are desired a total of 5 ml of spinal fluid is sufficient

STS AND COLLOIDAL GOLD CURVE

Three ml of spinal fluid is required for these tests *It should be noted that the colloidal gold curve is valueless and STS unreliable in the presence of blood in the spinal fluid whether traumatic or due to organic disease*

BACTERIOLOGIC EXAMINATIONS

1 Stained Smear

A Transfer the contents of tube no 3 to a sterile centrifuge tube and spin at high speed for 10 minutes

B Decant the supernatant fluid and save for the serologic test and colloidal gold

C Spread the sediment on 2 clean slides with a flamed platinum loop and allow to dry in air

D Fix the smears by gentle heating and stain by Gram method and with methylene blue (See Microbiologic Examinations and Collections p 169)

2 India Ink

A Centrifuge spinal fluid for 10 minutes at high speed Decant the supernatant fluid and save for Chemistry or Serology

B Put 1 drop of India ink on a clean slide Add an equal amount of sediment mix and cover with a clean cover slip

C Examine under high dry and low power for the presence of fungi.

3 Culture

See Microbiologic Examinations and Collections page 169

6 Pleural, Pericardial, Peritoneal, and Synovial Fluids

COLLECTION

In aspirating these fluids collect 5 ml in a blood bottle for the cell count and 10 ml in a sterile tube for routine bacteriologic examination Use an anticoagulant (heparin) if the fluid clots If the presence of tuberculosis or malignancy is suspected collect a larger volume for study (1 2 liters if possible)

GROSS EXAMINATION

Note the following

1 *Volume* Record in ml
2 *Color* Clear cloudy yellow brown, straw etc.
3 *Character* Watery mucoid fibrinous purulent, bloody
4 *Coagulation on standing*

SPECIFIC GRAVITY

This should be determined immediately If there is an unavoidable delay place 5 ml in each of 3 or 4 bottles to prevent coagulation

Transudates usually have a specific gravity below 1 015 and do not coagulate on standing Exudates usually have a specific gravity over 1 018 and frequently coagulate on standing

PROTEIN CONTENT

Transudates usually contain under 25 Gm per liter exudates usually over 30 Gm per liter

CYTOLOGY

1 Cell Count

If the fluid is not grossly bloody or purulent, perform a white cell count by the technique used either for blood or for spinal fluid depending on the number of cells present

2 Differential Cell Count

Make a smear of the centrifuged sediment fix by gentle heating and stain with Wright s stain (see Hematologic Pro cedures p 113)

In examining the stained preparation differentiate and record the relative percentage not only of the cells found in circulating blood but also of endothelial cells and ab normal cells

In patients suspected of having an underlying malig nancy about half the available fluid should be sent promptly to the Pathology Laboratory When fluid must be held it should be mixed with an equal volume of 10% formalde hyde and kept in the refrigerator If tuberculosis is sus pected send the remaining fluid (1 2 liters if possible) without added formaldehyde to the Microbiology Lab oratory

BACTERIOLOGIC EXAMINATIONS

When infection is suspected a direct smear of the sediment from 10 ml of fluid should be stained both with Gram s and acid fast stains and examined together with a fresh preparation of the sediment (see Microbiologic Examinations and Collec tions p 169)

7 Skin Testing

GENERAL DIRECTIONS

Skin testing for sensitivity to the products of certain pathogenic organisms, particularly those involving the lungs has a rather wide applicability In most instances the test materials should be administered intradermally A tuberculin syringe and a no 25 or 26 needle is employed and the intra dermal localization is assured by the raising of a bleb The test material should be carefully checked as to con entration expiration date reconstitution date and evidence that the material has been properly stored It is well to record the appearance of the test site 24 48 and 7 hours after administration The reaction should be carefully measured and described

SPECIFIC TESTS

1 The most widely used skin test is the *Tuberculin Test* The intermediate strength purified protein derivative PPD is adequate for routine purposes and is approximately the equivalent of Old Tuberculin in a 1 1 000 strength First strength PPD may be used when a severe reaction is suspected to have occurred in the past Second strength is employed in those with a negative reaction to the intermediate strength test
2 The commonly used *Fungus Skin Test Antigens* are *Blastomycin Histoplasmin* and *Coccidioidin* This form of skin test has become very widely used as these diseases have gained clinical importance The 3 antigens mentioned should be used simultaneously in order to facilitate the interpretation of cross sensitivities particularly involving the latter 2
3 A heterogeneous groups of antigens each of which may have occasional application includes the *Trichina Antigen*

Lygranum (for *Frei Test*) *Diphtheria Toxin* (for *Schick Test*) *Echinococcus Antigen* *Toxoplasma Antigen* and *Cat Scratch Disease Antigen* The last 3 antigens are not easily available or widely applicable The *Kveim Test* for sarcoidosis is at times helpful but the antigen is not easily available or well standardized

8 Microbiologic Examinations and Collections

GENERAL PRINCIPLES

1 *Prior if possible to chemotherapy of any form* collect *suf ficient* material of the variety most likely to contain the causative organism
2 Be sure that the *uncontaminated* specimen reaches the lab oratory as soon as possible after collection
   A Many organisms are susceptible to injury by drying exposure to air and chilling When indi ated or when the specimen is unavoidably small the laboratory should be requested to bring the culture mediums and slides for smears to the bedside and should be told which of the requested studies are most important
   B Normal flora or contaminants may grow to such an extent during transportation of specimens as to obscure the pathogens present
3 Select the proper container and appliance for collecting each specimen *Do not contaminate the outside of the con tainer* Make sure that the *patient* and the *source of the specimen* are clearly and unmistakably identified
4 Optimal volumes for blood cerebrospinal fluid and other specimens are indicated below but it is recognized that particularly in pediatric patients only smaller volumes may be available The laboratory staff will do its best to employ the available specimens effectively

EXAMINATION OF FRESH PREPARATIONS AND STAINED SMEARS

1 Examinations Indicated

As a general rule the physician responsible for the patient

Lygranum (for *Frei Test*) *Diphtheria Toxin* (for *Schick Test*) *Echinococcus Antigen* *Toxoplasma Antigen* and *Cat Scratch Disease Antigen* The last 3 antigens are not easily available or widely applicable The *Kveim Test* for sarcoidosis is at times helpful but the antigen is not easily available or well standardized

normal saline The number and type of formed elements should be noted and if the presence of fungi is suspected the addition of 20% NaOH or 5 10% KOH to the material on the slide may facilitate their demonstration

The laboratory staff examines some specimens directly *The primary responsibility for most of these studies usually rests however with the responsible physician* The laboratory staff gives directions regarding the preparation of materials for study and will supply the needed stains and solutions It will also examine smears or preparations brought to the laboratory if questions should arise

TYPES OF SPECIMENS

1 Blood for Culture

Members of the laboratory staff collect blood specimens for culture except on pediatric patients The routine procedure for blood culture utilizes trypticase soy broth thioglycollate broth and poured plates The cultures are studied for a period of 7 days This procedure is designed for the isolation of all common pathogens Request Routine Blood Culture except when the following are suspected subacute bacterial endocarditis brucellosis Neisseria species septicemia Bacteroides septicemia pneumococcal septicemia In these instances make the request specific for the suspect organism or group of organisms

2 Blood for Direct Examination

When infections such as malaria rat bite fever relapsing fever kala azar etc are suspected consult the laboratory concerning preparation of blood for direct examination

3 Specimens from Nose Nasopharynx Pharynx Ears Mastoids Paranasal Sinuses and Larynx

Sterile Bradford swabs (cotton tipped wire) and cotton tipped wooden applicators are to be used and then immersed in tubes containing trypticase soy broth to prevent drying If frank pus or tissue can be obtained it should be sent in a sterile tube or bottle

should make the indicated direct examination on various specimens as follows

A SPUTUM *Gram* and acid fast stained smears KOH preparation and Wright s stain

B *URINE FROM PATIENTS SUSPECTED OF HAVING INFECTION OF THE URINARY TRACT* A Gram stained smear of the sediment

C PUS AND EXUDATES FROM VARIOUS SOURCES A *Gram* stained smear Also an acid fast stained smear and a KOH preparation may be indicated

D CEREBROSPINAL FLUID *Gram* and methylene blue stained smears

2 Staining Techniques

All smears should be *fixed* before staining by *gentle* heating over a gas flame Do not overheat

A METHYLENE BLUE STAIN Flood the slide with methylene blue solution *for* 1 minute Wash under running water and dry by blotting

B GRAM STAIN Flood the slide with gentian violet for 1 minute Wash gently with water Flood the slide with Gram s iodine *solution* for 1 minute Wash gently with *water Decolorize with acetone ether until the fluid is* no longer blue tinged Flood the slide with safranin for 30 seconds *Flood* the slide with water and dry by blotting

C GENTIAN VIOLET STAIN FOR VINCENT S ORGANISMS Flood the slide with gentian violet for *30 seconds* Wash and dry by blotting

D ACID FAST STAIN Flood the slide with Kinyoun s stain for 3 5 minutes Decolorize with acid alcohol until only a faint pink color *remains* Wash with water Flood with methylene blue for 1 minute *Wash* with water and dry by blotting

3 Wet *Smears* and KOH Preparations

Certain specimens (sputum pus vaginal discharge urine sediment) may be advantageously examined as wet *preparations* either without alteration or after dilution with

the margins and angles of the lids Specimens from the cornea are obtained with special instruments by an oph thalmologist Previous arrangements should be made with the laboratory for immediate examination and culture of these specimens since they tend to dry rapidly and be come unsatisfactory for study The type of studies desired may be discussed at the time the laboratory is asked to schedule the culture If a routine culture of exudate is desired request Culture for Aerobic Flora" This will be accomplished by inoculation of human blood agar chocolate blood agar thioglycollate broth and trypticase soy broth which will permit isolation of most of the com mon bacterial pathogens

5 Sputum and Bronchial Secretions

Direct examination of Gram Wright and acid fast stained smears and of fresh preparations of sputum should be performed by the responsible physician as a part of the initial examination of every patient with suspected pul monary infection

Fresh sputum for culture of the common aerobic and anaerobic flora is collected in sterile 6-oz plastic lined paper cups with tops Have the patient rinse his mouth thoroughly with water to clear it of saliva Then instruct him to cough and expectorate directly into the container which is sent immediately to the laboratory When feasi ble an early morning specimen is usually most suitable for study The physician requesting the specimen should make sure that a specimen of sputum is obtained Saliva is not acceptable for culture Negative results on poor specimens are of no value

The routine study of sputum is accomplished by inocu lating a tube of thioglycollate broth desoxycholate agar and human and sheep blood agar plates This permits the isolation of most of the common pathogens Routine Culture should be requested with the following excep tions

A When a *lung abscess* or *suppurative pneumonitis* is suspected request Routine and Anaerobic Culture with Anaerobic Plates.

A NOSE Pass a sterile swab without touching the an trum first above then below the lower turbinates The specimen is cultured on human blood agar

B NASOPHARYNX Pass a Bradford swab straight back *through the nose* until it comes in contact with the posterior nasopharyngeal wall then rotate the swab gently in this position before removing it The speci men is cultured on human blood agar

C OROPHARYNX Thoroughly rub the back of the pa tient s throat and tonsils or tonsillar fossae being care ful not to contaminate the swab as it is passed through the mouth The specimen is cultured on sheep blood agar and a sheep blood agar pour plate is made to detect beta hemolytic streptococci

The foregoing procedures permit identification of the more common aerobic bacterial flora of these areas If the following organisms are suspected the physician should request special studies for them group A streptococci *Corynebacterium diphtheriae* fusospirochetal symbiotic disease (Vincent s angina) (submit thin smears of material from lesions) *Neis seria meningitidis Hemophilus pertussis* anaerobes When tuberculosis or infection with molds yeasts or actinomycetes is suspected perform direct examina tion and request direct examination and culture for the organism suspected

D PARANASAL SINUSES EARS MASTOIDS These are usually collected by a member of the E N T Service and cultured on human blood agar and desoxycholate agar and in thioglycollate broth

F LARYNX These specimens are collected by a member of the E N T Service and cultured on human blood agar If tuberculosis or a mycotic infection is sus pected a biopsy specimen of the lesion should be submitted *with a request slip indicating which studies* are desired

4 Specimens from the Eyes

Exudate from the conjunctiva may be collected on small cotton swabs after washing the eye with *sterile normal* saline to remove superficial exudate Avoid contact with

7 Cerebrospinal Fluid

When possible at least 5 cc of cerebrospinal fluid in a sterile test tube should be sent immediately to the laboratory The routine procedures for study of spinal fluid allow the isolation of the more common pathogens and consist of studies of Gram and methylene blue stained smears and culture on human blood agar chocolate agar trypticase soy broth and thioglycollate broth All cultures except the last are incubated in an atmosphere of about 10% CO Request Routine smear and culture except when the following are suspected

A TUBERCULOSIS Submit 10 ml of fluid in a sterile tube and request Smear and culture for *M tuberculosis* This request may not be combined with requests for other studies since studies for *M tuberculosis* usually are performed in a separate laboratory

B CRYPTOCOCCOSIS Submit 5 ml of fluid in a sterile tube and request Direct examination and culture for fungi

8 Pleural Pericardial Peritoneal and Synovial Fluids

Small amounts of these fluids may be sent to the laboratory in sterile test tubes Larger amounts (1 2 liters) may be sent in the large bottles that are included with the collection tray The routine method of studying such fluids includes examination of a Gram-stained smear and aerobic and anaerobic cultures When a pyogenic infection is suspected request Routine smear and aerobic and anaerobic culture

A When tuberculosis is suspected send a separate specimen and request Smear and Culture for *M tuberculosis*

B When infection with one of the molds yeasts or actinomycetes is suspected request "Direct examination and Culture for Fungi, including Actinomycetes

9 Urine

(See section on Urine page 137 for details of collection of specimens and special examinations and bacteriologic studies)

B When an *infection with molds yeasts* or *actinomycetes* is suspected request Direct Examination and Culture for Fungi Including Actinomycetes Routine culture may be requested on the same specimen if desired

C When *M tuberculosis* infection is suspected a *separate specimen* in a 6-oz plastic lined paper cup must be submitted This is essential since these specimens usually are processed and studied in a separate laboratory The patient s name is written on the outside of the cup (not on the lid) A *24 hour collection* of sputum is most satisfactory for this study Leave the container at the bedside until collected early each morning for *prompt* dispatch to the laboratory Request Smear and Culture for *M tuberculosis*

D *When H pertussis infection is suspected it is best to collect a nasopharyngeal cough specimen with a Bradford swab Schedule study of the specimen with the laboratory in advance*

E *Bronchial secretions* are collected in special containers such as Tucker or Clark collectors Request studies as outlined for sputum *Specify if studies for M tuberculosis are requested in addition to other studies* Only 1 specimen is required If the specimen is small indicate which studies are most important

6 Gastric Washings for M tuberculosis

Within 30 minutes after the patient awakens while he is fasting and before he gets out of bed pass a *sterile* Levin tube and aspirate the gastric contents with a sterile 50 cc syringe If 50 ml of material is not obtained have the patient drink 50 ml of water and reaspirate until about 50 ml of material is obtained Place the specimen in a *sterile* urine bottle cap with a sterile top and send to the laboratory early in the morning Specimens deteriorate *if not* processed shortly after collection Request *Culture for M tuberculosis* Smears of gastric washings are *of no* value and should not be requested

diarrhea request Culture for Pathogenic Species of *E coli* Special attention will be paid to the *E coli* of the flora When enteric tuberculosis is suspected consult the laboratory staff concerning methods of study

B SPECIMENS FOR PARASITOLOGIC EXAMINATION Routine examination for ova and parasites may be accomplished by sending stools collected in plastic lined paper cups as described above to the laboratory Request Routine Examination for O and P * When a patient is suspected of having amebiasis the following procedure is suggested

1) Collect specimens before the patient has received antibiotics that affect the stool flora Administration of the broad spectrum antibiotics makes examination for Amoeba unsatisfactory
2) Avoid presence of *barium bismuth oils* and *oily suspensions* in the specimen A lapse of 72 hours after administration of such preparations is necessary before suitable specimens can be collected.
3) *Collect* 3 normally passed stool specimens Obtain each at a different defecation *Collect* 1 purged stool Do not use castor oil or magnesium sulfate to purge the patient Sodium sulfate is satisfactory Try to obtain a specimen that contains only small amounts of formed fecal material *Collect* 1 specimen by using a high enema with tepid physiologic saline Supervision to insure that the ileocecal region is reached is important. The last portion of the defecation is preferred *Collect* 1 specimen at the time proctoscopic examination is performed Special swabs for collecting these specimens may be obtained from the laboratory After collecting the specimen, replace the swab in the test tube containing saline solution

It is essential for best results that all liquid stools be examined immediately after collection and formed stools within a few hours after collection Maintenance of the

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* Wh n th p ese ce f S gyl d l alis is suspected addition to tool specim spec m of duod nal cont ts may be llected with a Levin t be pla d n d urine bot l d e t l examı tın Reque t Examination f Stro gylo des

When tuberculosis is suspected collect a 24 hour urine specimen in a large sterile bottle which should be kept cold (4 C) during the period of collection Avoid filling the bottle to the top Cap the bottle tightly and send it (while still cold) to the laboratory as soon as possible after collection is completed Request Culture for *M tuberculosis* Smears on urine specimens for acid fast organisms often disclose nonpathogenic acid fast organisms and may be very misleading They are not recommended as a method of study

10 Feces

Specimens are sent to the laboratory in 6 oz nonsterile plastic lined paper cups with lids Each specimen should consist of 50 to 100 Gm (2 3 oz) *It is unnecessary to send the bedpan to the laboratory The outside of the container should not be contaminated* The patient s name should be written on the container and the specimen should be accompanied by a completed request form The specimen must be free from barium bismuth and oily suspensions and should not be mixed with urine The patient may be instructed to pass the stool directly into the container The specimen should be sent to the laboratory immediately

A SPECIMENS FOR BACTERIOLOGIC STUDIES For detection of Salmonella species Staphylococci and pathogenic species of *Escherichia coli* the collection of specimens as described above is satisfactory Shigella species may be isolated by this method these organisms are very sensitive to factors in the outside environment however and the incidence of isolation can be increased by collecting a specimen direct from the anus with a rectal swab or at the time a proctoscopic examination is performed and immediately inoculating media at the bedside Media and instructions for inoculation may be obtained from the laboratory

The routine method of culturing stools includes the use of enrichment media differential and selective media and a special plate for staphylococci This is satisfactory for detecting all the common pathogenic bacteria When *E coli* is suspected of causing infantile

B If an infection with a mold or a yeast is suspected, request "Direct Examination and Culture for Fungi." Request special cultures for Actinomycetes if these are suspected.

C If a gonococcal or meningococcal infection of a joint is suspected, request "Smear and Culture for Neisseria Species" This may be combined with the request for routine culture

12 Darkfield Examinations

These may be arranged specially by consulting the staff of the laboratory

SENSITIVITY STUDIES

When it seems probable at the time cultural studies are requested that sensitivity studies will be needed, write "Hold for sensitivity studies" on the request slip The house officer usually is responsible for choosing sensitivity studies, if these are necessary within 48 hours of the time laboratory personnel have reported the organisms If in doubt as to which antibiotics are most likely to be effective request Infectious Disease Service consultation

stool specimen at body temperature is *not* essential If a specimen must be stored overnight it should be held at 4 C

The routine method of examining stool specimens for ova and parasites includes direct examination of unstained and stained (Quesnel stain) specimens and examination of concentrated specimens Cultures are done on selected specimens after consultation with the laboratory service

When a patient is suspected of having pinworms (*Enterobius vermicularis*) use a Graham swab which is a *modification of the popular NIH swab for collecting the specimen This consists of an 8 × 1 cm strip of cellophane adhesive tape Press the sticky surface of the tape* over the perianal area and then place the sticky side down over a clean slide and send to the laboratory

11 Pus from Wounds Abscesses Pyarthroses and Various Other Lesions

Pus may be collected from closed lesions by means of a syringe and needle and transferred to a sterile test tube The use of cotton swabs is to be avoided if possible When feasible use a sterile dropper for collecting small amounts of pus from open lesions Several ml may be collected and placed in the dropper bottle or if only a small amount is obtainable it *may* be left in the dropper which *is replaced in* the bottle If no fluid can be collected with *the dropper and the surface of the lesion is swabbed with* a cotton swab as a *method of collecting pus 2 swabs immersed in 1 ml of trypticase soy broth should be sent* to the laboratory *for culture (Do not break off sticks)*

The routine method of culturing specimens of pus includes the inoculation of a human blood agar plate differential media for the enteric organisms and culture in thioglycollate broth and a tube of trypticase soy broth These methods permit the isolation of all the common pyogenic organisms Request Routine Aerobic and Anaerobic Culture except—

A If tuberculosis is suspected submit a separate specimen and request form and request Smear and Culture for *M tuberculosis*

Serologic Examinations of Blood

D ea	Te	Amt of B ood (m)	No S ct ns
Syph l	STS	5	1 dmiss on
	Trep m c mpl me t fix ti	5	1—spec 1 f rm d nsult t n w th lab
Typh d d p ratypl d	Aggl t ati	5	Acut phas d w kly x
Bru llosis	Aggl ti t	5	Acute phase d w kly x2
Tul mia	Aggl t t n	5	Acute phas d w kly x2
Leptosp rosis	Aggl ti ti n	10	A t phase d at 2 w k t rvals 2
Gro p A strep	A ti trept ly n 0	10	A te phase d t 2 w k t rv l
Gonorrh	Compl m t fixat n	5	A ute phase d t 2 w k t rv l
Hist pl m Bla t my os C c d d my os	C mpl m t fixat d p c p t	10	Acut phase a d t 2 3 w k t rv l
Rocky Mt p tt d M typh Q f	Compl m t fix ti d W l F l (P t us OX 19 OX 2 OX K)	10	Ac te ph d t 12 15 d y t rv l
I f ct us m l	H t roph l ggl ti t d ff ti l bsorpt o	10	Ac te phase d w kly
Atyp c l p	Cold ggl t t d t pt coc M G ggl t ti n	10†	A ut ph a d w ekly
Rh m t d th ti	Fra t II l c p ti le H t ph l -abso bed h p c ll	10	M thly
Lymph cyt c h m g t s Mumps	Sl d late p t l		
E t & w t m q phal myel t St Louis ph l ti I ff A B I tt cos d Lymph gr l m reum gr p	Compl m t fixat	10	A t ph e d t 2 w k int rval
T plas os	M thyl blu	5	C lt l b
T ul osis T l ococ os s	C mpl m t fixat	5	A t phas d nd w k
F f u k w gi		0	Ac t phas (h ld for futur f renc)

*Wh d gnos is d bt se d 70 c f blood to l boratory very w k to be h ld for f ture t d Wh n thre t d es are d d 10 c e s fici t

†U refrigerat d blood

9 Serologic Tests

BLOOD

When blood is collected for serologic tests it is important that the following precautions be observed Use a dry sterile syringe Use aseptic technique and collect the required amount of blood as indicated in the following table Place the blood in 1 or more if necessary sterile 100 × 16 or 100 × 13 mm tubes without anticoagulant Stopper the tube with a sterile rubber stopper Write the patient s name unit number and date of collection on the label that is on the tubes supplied Complete the request slip which must be signed by the physician making the request Attach the request slip to the tube Send the specimen to the Serology Laboratory When possible collect blood after a period of fasting (i e before breakfast)

The demonstration of a change in titer of specific antibodies in the blood of patients requires the study of at least 2 specimens

In addition to the tests listed in the following table most serologic laboratories also perform the following tests on serum upon request (1) C reactive protein (2) cryoglobulins (3) bacterial hemagglutination tests (patient s serum tested against antigen extracted from an organism isolated from the patient)

CEREBROSPINAL FLUID

See page 163

ADDITIONAL COLLECTIONS

Serial and supplementary specimens are frequently indicated. These collections should be planned in cooperation with the Virus Laboratory

In the rare situation in which consultation is not practical the following outline may be useful

1 Two additional stool specimens as early in the course of the illnes as possible
2 Ten to 15 ml of clotted blood before discharge and on a return visit in 3 to 6 weeks

HANDLING OF SPECIMENS

It is usually advisable to make arrangements for temporary storage of specimens that cannot be delivered to the Virus Laboratory within 30 minutes of collection

1 Clotted blood should be refrigerated but not frozen before aseptic separation of serum. After removal from the clot serum may be frozen
2 All other specimens should be refrigerated, preferably in the freezing compartment

Specimens should be clearly labeled in pencil with the patient s full name unit number and date of collection

When specimens are to be collected by another physician after discharge from the hospital appropriate instructions regarding handling and mailing can be obtained from the Virus Laboratory and sent to him

10 Collection of Specimens for Virus Studies

INTRODUCTION

At present virus studies in most laboratories are only applicable to selected clinical case material In order to collect initial specimens that are appropriate to the clinical problem and adequate for study the physician should call the Virus Laboratory for consultation before submitting specimens If consultation cannot be obtained promptly the following outline of initial collection and preliminary handling of specimens may be helpful Of course consultation with the responsible laboratory personnel concerning the clinical problem is still strongly indicated at the earliest opportunity

DAY OF ADMISSION

1 **Clotted Blood**

10 to 15 ml collected aseptically in a sterile test tube

2 ***Cerebrospinal Fluid***

2 to 3 ml in a sterile test tube (if a lumbar puncture is indicated)

3 ***Throat* Swab** in 3 ml of broth

4 **Stool Specimen** in a 6-oz clean but not sterile plastic lined paper cup

5 ***Aliquot of Transudate or Exudate*** (pericardial pleural peritoneal articular etc) in a sterile test tube

person In most Blood Banks blood is not released to orderlies aides or other nonprofessional individuals The person taking the blood must check the names and numbers on the bottles donor cards and requisitions After 5 00 P M and on weekends most Blood Banks have a special log book which must be filled out Most transfusion reactions result not from cross matching errors but from administration of blood to the wrong recipient Therefore scrupulous careful double-checking is essential

Most blood will be in plastic bags some will be in bottles The principle of administration is the same with both types of containers Blood should be administered as soon as possible after removal from Blood Bank refrigerators Potentially fatal reactions increase in proportion to the time the blood is warm and the number of times the container is entered Therefore blood which is not given promptly should be discarded Storage in other refrigerators such as those at nursing stations is not adequate Blood which has been out of the Bank for more than 30 minutes or which has been entered may not be returned for re use Once the pilot tube is removed the blood cannot be re used by the Bank and is usually charged to the service

It is suggested that medications such as antihistamines not be added to blood but, if desired administered separately

If any kind of transfusion reaction occurs blood infusion should be immediately discontinued and 10 ml of the patient s blood drawn This and the remainder of the donor blood should be returned to the bank promptly for smear culture and recross match In addition the hemoglobin in the patient s serum should be determined The next sample of urine obtained from the patient following the reaction should be checked for hemoglobin

The commonest types of transfusion reactions are (also see tabulation on pages 186 and 187)

1 Hemolytic reaction due to blood group incompatibility
2 Pyrogenic reaction
3 Allergic (urticarial) reaction
4 Volume reaction due to circulatory overload
5 Air embolism

In addition delayed reactions due largely to infectious agents may occur

11 Use of the Blood Bank

GENERAL

It is important to learn the location and regulations of the Blood Bank so that its facilities may be effectively used particularly in emergencies In addition to typing and cross matching the following procedures usually are carried out

1 Coombs antiglobulin test
2 Rh sensitivity and titer
3 Rh subgroups and other minor blood groups when indicated within the limits of availability of antisera
4 Investigation of hemolytic anemias and rare antibody studies on consultation

For the foregoing procedures 5 ml of clotted blood *should be submitted with the appropriate requisition*

BLOOD FOR TRANSFUSION

To obtain blood for transfusion the appropriate requisition should be submitted with a specimen of the patient s clotted blood Five to 10 ml is usually sufficient depending on the number of units requested If 6 or more units are needed 15 ml will be required This should be submitted as soon as possible before the time the transfusion is to be given Transfusions for patients admitted for surgery *should be requested by 3 00 P M of the day before the transfusion is to be given Routine requests for transfusion* when *the patient is not in dire need* of the blood should be in the Blood Bank by 2 00 P M or they will be postponed until the following morning Emergency transfusions may of course be requested at any time The telephone operator will have the name of the technician on call for emergency cross matching at night and on weekends

When blood is to be given it must be checked out of the Blood Bank by a *house officer nurse or other responsible*

Py e	I trod t t blood t m f f re g m t l (p t d d bl d g d d ba t n b t l m t h l tes t —E d gly m ll m ts f py og s bsta es w ll au t (Py g f p od)	C d al sy pt m —M ld Sl gl t h ll M ld f —S re (ra ly f t l) Prol ged ch ll (du g r lt t f) —F (1 4 h l t) —R) d k d p t t	U b ve proc du t rul t h molyt re t	P t —U disp bl q pm t a fully f ll w tru t ns f l g d t l g q pm t A t —St p t fus n t first g f t —Cal m gl t (I V)
All g c	I t du t f d ll g t p t t blood P tra f f d hyp rs t vity	Urt ca Asthm A g t d m	St dy pat t f a s f ll gy	P t —U fast g d rs —D t u ll g c d rs 4 t —St p tra fu n l ss o ly ympt m m ld u t ca a —I p ph e hyd ocl l d —A t h t m
C l t ry O l od	R p d dm trat f bl d t p t t w th w k h t	P lm ry d m S gn f d f l C d rr t		P t —E pt tr m em r g y t ke t l t l h to g 500 ml of bl od —D t erl ad p t ent w th I V fl ds
Emb l c	Adm istration f —Bl od co ta g cl ts —A	Symptoms of mbol m		Pr e t v —Always filt r bl d —Do n t g ve bl d u d press f o d bl be cause f d g r of m bol m

C t y f D R F B g
†N t ll h m lyti t fus t r d e t t h q For furthe f rm t c e g r ct as ll as th r bl d h k pr bl ms th f ll w g f re us ll t M ll P L Bl od Tra fus o n Cl cal Med cin (2 d ed Sp gf eld Ill Ch les C Th mas P bl he 1956)

CLINICAL ANALYSIS OF TRANSFUSION REACTIONS*

CLASSIFICATION	ETIOLOGY	CLINICAL FINDINGS	LABORATORY PROCEDURES	TREATMENT
H m lyt c —Int ascul h m ly f mp t bl d n ll		H m lyt (1-4) d rat) O t u u lly ft 100 200 ml ... ty d pend la g ly n ant body t t f p t um	V n punctu e mmed at ly nd 6-18 h ft ca t H m gl b n m and b l rub n n a U naly (w tl n 4 1) —Colo da k b n h t d —I mt n pos t —B n d pos t —M c o py f w r d d p g n t d lls	*P at* —U of m t cul u labora t ry t ch ique ca efully p ev d —A da e f m tak s in lab l ng flasks tc —A d e of u of fro n blood old bl od te
Inte g p (ABO)	Adm istrat n f —A B o AB blood t gro p O recip t —B AB bl d to gr up A p t —A AB bl od t g up B p t	*Lo d nal sympt m* —T in n b d g n caliz d t gl e ub st n l pp n		*A t* —St p tran fus on at first sign f r t n —Ep phri e hydrochlo d —T eat h ck f t d v lops —Th e is no sat f t y treatment of renal mpl t tl o gh ma y st ll r mme d lkal t
I t grp p (Rh)	Adm istrat n f Rh blood to n t d Rh g p t t	—Lumb pa n —Chill f llow d by T t 105 F *Oth f d ngs* —Restl n ss a x ty —N us a nd om ting —Coll p Low bl d pre u *R n l mpl t n* M ld T an nt l gu a w th nitr g n e t nt n S re —I t nt l gu a —D th n u m n 4-10 d ys nl s d u	R ch k g up ng d Rh type f pat nt a d blood n d o flask	
—I t a asc l h m ly f p t s ll	Ad trat n f —O blood i gh t nts 4 t B ggl t t A B AB rec p nt		R ch k m t h ng C trif g bl od from d o fl k f p e n of hem l ys s	
—Int sc l h m ly f mpat bl d n lls	Adm trat n f —O g blood —Bl od st d t t h gh temperatu		If Rh n g h k t p nts blood f nt Rh agglut n If d no gr p O d p t gro p A B AB t trat don rum aga t cip t c ll	
—T f f l mofy d blood	Adm t t n of blood f w ng h m lys s du t —P t h iqu n coll t n —F o			

12 Use of the Clinical Chemistry Laboratory

INTRODUCTION

Clinical chemistry determinations have assumed an increasing role in the diagnosis and management of complicated illnesses in recent years this is due in part to technologic advances and in part to improved understanding of pathologic physiology and the interpretation of the values obtained The laboratory however can be of the greatest assistance to the clinician when it is not misused Each study requested should have a specific indication namely the obtaining of meaningful data Values should not be obtained for the record The manner of selection and handling of the specimens is of vital importance Blood for chemistry determinations should be placed under oil from the collecting syringe dispatched to the laboratory and the red cells and serum separated by centrifugation Hemolysis is ordinarily not a major problem when these specimens are carefully handled and even ½ % hemolysis is easily noted by the alert technician Failure to separate the cells from the serum may result in significant errors for example within 2 hours at room temperature as much as 0.5 to 1.0 mEq /liter of potassium may leak from the red cells into the serum an even greater rise may occur in serum inorganic phosphorus The circumspect use of the Clinical Chemistry Laboratory with careful attention to details will often make an important contribution to the understanding of the clinical problem

Clinical chemistry determinations should not be relied on to the exclusion of simple clinical observations in particular serial weights intake and output records Often simple laboratory studies are helpful in interpreting chemical data

Following any transfusion particularly one given during anesthesia the container should be saved for 24 hours before discarding since some reactions may not become apparent for several hours

The following products other than blood usually are available in the Blood Bank for clinical situations in which they may be useful

1 *Plasma*—aged individual units Pooled plasma is not available
2 *Fresh Fro en Plasma*—primarily for use in hemophilia
3 *Old Fro en Plasma*—for use in Christmas disease
4 *Salt Poor Serum Albumin*

DONORS

Most blood used is obtained from blood donors who come to the hospital Therefore it is imperative to have an effective and continuing program of donor recruitment by the house staff *Each patient receiving blood is charged for it* Repayment of blood by donors is urged but blood which is not replaced for him will be charged

Usually a system of credits and debits for each clinical service is in effect Each service is required to furnish enough *donors to maintain a positive balance in the bank If any* service does not have a positive balance no transfusions may be given to a patient on that service and no patient for elective surgery should be operated on unless they have prior credit in the bank Two exceptions to this rule will be allowed

1 Patients *who have furnished sufficient donors to have indi*vidual blood credit should not have transfusion delayed because of a service deficit
2 Patients presenting bona fide *emergencies* may receive transfusions Blood will be debited to the service

Red Cross Blood Different relations with Red Cross regional banks exist in different parts of the country The hospital blood bank supervisor should be consulted for rules governing each locality

Phlebotomy for therapeutic purposes usually is not done by Blood Bank personnel *although necessary equipment is fur*nished Such blood is not accepted in the Bank for general use

sufficient to increase the concentration by several hundred mg per 100 ml

B Hypoglycemia

If this is the problem to be evaluated—

1) Obtain a fasting specimen of blood
2) Administer 50 ml of 50% glucose intravenously (Pediatric age group as above.)
3) Obtain specimens of blood at 2 3 4 and 5 hours The 3 4 and 5 hour specimens should be normal A full day s fast or more may at times be required in an effort to exclude organic hypoglycemia the hallmark of which is fasting hypoglycemia

C Insulin sensitivity

Regular insulin (0 1 units/kg) may be given alone or following the administration of glucose in an effort to evaluate insulin sensitivity This procedure is fraught with the hazards of hypoglycemia and the indications for its use are quite limited

2 Congo Red Test

A Obtain a fasting specimen of blood

B Administer 0 25 ml /Kg body weight of 0 6% solution of congo red in 1 to 2 minutes

C Obtain a minimum of 3 specimens of blood *carefully timed* from the midpoint of the injection within the first 6 minutes

D Obtain a specimen of blood at 30 minutes All of the postinjection specimens should be obtained from the arm opposite that of the site of administration of the dye

E Send an aliquot of the 0 6% solution of congo red to the laboratory

This is the least ambiguous of the congo red tests Patients with amyloid disease may remove more than 65% from the plasma whereas controls rarely remove more than 35% of the dye The levels obtained in the first 6 minutes when plotted semilogarithmically back to zero time provide a good estimate of the initial concentration of dye when thoroughly mixed in the blood

COMMENTS REGARDING CERTAIN DETERMINATIONS

1 Serum Electrolytes

The interpretation of serum electrolytes is frequently facilitated by study of the several major components namely sodium potassium CO_2, chloride and blood urea nitrogen

2 Calcium and Phosphorus

These determinations should ordinarily be made simultaneously together with the serum alkaline phosphatase Because of the interrelationship of ionized and bound calcium a serum protein determination should be obtained on the same specimen of blood

3 Thyroid Function Studies

Available specific tests include protein bound iodine (PBI) butanol extractable iodine (BEI), and I uptake The basal metabolic rate and serum cholesterol content are nonspecific but may be helpful in certain instances The usefulness of the PBI and BEI may be limited by recent intravenous pyelogram (4 6 weeks) cholecystogram (6 months) or Lipiodol (perhaps years) The PBI has the additional disadvantage of spurious elevation by exposure to inorganic iodides

SPECIAL PROCEDURES

1 Glucose Tolerance Tests

A IMPAIRED CARBOHYDRATE TOLERANCE If this problem is to be evaluated—

1) Obtain a fasting specimen of blood
2) Administer 50 ml of 50% glucose intravenously (Use 0 5 Gm glucose/kg in the pediatric age group)
3) Obtain a 2 hour blood specimen

A common error is to use the needle employed to aspirate the 50% glucose into a syringe for the withdrawal of the fasting specimen of blood This seemingly minor contamination of the initial specimen of blood is

TABLE OF NORMAL VALUES

DETERMINATION	MIN VOL. OF BLOOD NEEDED (ML.)*	NORMAL RANGE
Urea nitrogen	5	8 20 mg %
Glucose (Somogyi)	5	55 100 mg %
Total CO content†		
Infant		20 25 mM/L
Adult		26 30 mM/L
Chloride	5	
Newborn		104 110 mEq /L
Adult		98 106 mEq /L
Sodium	5	137 142 mEq /L
Potassium	5	
Newborn		5 0 9 0 mEq /L
Adult		3 5 5 0 mEq /L
Total protein	5	
Newborn		5 1 5 7 Gm %
Infant		5 8 6 4 Gm.%
Adult		6 0 7 8 Gm %
Albumin		3 5 5 0 Gm.%
Globulin		
Infant		1 0 2 0 Gm %
Adult		2 0 3 5 Gm %
Calcium	10	
Newborn		7 5 13 mg %
Adult		9 0 11 5 mg %
Phosphorus inorganic	5	
Newborn		3 5 8 5 mg %
Infant		4 5 5 5 mg %
Adult		2 5-4 5 mg %
Bilirubin	5	
1 min		Less than 0 6 mg %
Total		Less than 1 mg %
BSP	5	Less than 5% retention in 45 min
Serum glutamic oxaloacetic transaminase	40	8-40 units
Serum glutamic pyruvic transaminase		5 35 units
Serum iron	15	50 200 µg %
Serum iron binding capacity	15	300 350 µg %

(C t d

A rly full tri g tube bo t 1 ml
†If pos ble se d separa be for CO_2

3 Bromsulfalein (BSP)

A PRINCIPLE Removal of BSP injected intravenously depends on presentation of the dye to the liver by an adequate liver blood flow normally functioning parenchymal cells of the liver and unobstructed biliary passages

B METHOD The dosage of dye is calculated using 5 mg of BSP per Kg of body weight. No correction of weight for edema or ascites is necessary An appropriate amount of dye is injected intravenously over 1 to 2 minutes with great care that no dye escapes into surrounding tissues since a painful slough of tissues may result Rarely hypersensitivity reactions occur most often in patients who have received BSP repeatedly and when doses of more than 10 ml are used Forty five minutes after the injection 10 ml of blood is taken from a vein in another extremity and submitted to the Clinical Chemistry Laboratory in an oiled tube

C INTERPRETATION The BSP test is one of the most sensitive tests for detecting minimal liver disease Decreased liver blood flow in patients with congestive heart failure or shock may cause retention of more than 5% of BSP in 45 minutes in the absence of parenchymal cell dysfunction Obstruction of the biliary passages will also cause BSP retention The technical feasibility of an adequate BSP determination is not precluded by the presence of icterus

VALUES

The normal values for certain determinations not discussed here appear in the following table together with certain other liver function tests

13 Endocrine Examinations

INTRODUCTION

The laboratory may make a significant sometimes critical contribution to the diagnosis of endocrine disorders The number of highly specialized techniques in this area is steadily increasing It is unlikely that the student house officer or practicing physician will often be one involved in the carrying out of these techniques and a detailed discussion of the methods or interpretations is beyond the scope of this manual The tests however specialized are no better than the specimens sent to the laboratory It is the physician s responsibility when he requests such studies to assure that urine and blood collections are obtained in the manner prescribed by the local laboratory and that clean glassware is employed of particular importance is the timing of the specimen A 24 hour urine specimen which is a frequent standard of reference should be *precisely* timed If despite efforts to obtain precise collections specimens of urine are inadvertently discarded lost in the x ray department or rendered faulty by any other unavoidable accident the known factors should be carefully included in the determination and interpretation of results

STUDIES OF THYROID FUNCTION

Thyroid function studies are discussed in the preceding section

COLLECTION OF 24 HOUR URINE SPECIMENS

1 General

Changes in methodology frequently alter the specifications of urine collection and one should be sure to follow the current procedure Most determinations are carried out on an aliquot of a 24 hour specimen Because of the large

TABLE OF NORMAL VALUES (*cont*)

DETERMINATION	MIN VOL OF BLOOD NEEDED (ML)*	NORMAL RANGE
Alk phosphatase	6	
Child		3 0 13 0 units (Bodansky)
Adult		1 5-4 0 units (Bodansky)
Acid phosphatase	6	Less than 0 6 units
Cephalin cholesterol flocculation	3	0 2± in 48 hours
Cholesterol		
Total	5	150 250 mg %
Free	5	26 32% of total
Amylase	5	*Less than 145 units*
Uric acid	6	
Male		Less than 6 mg %
Female		Less than 7 mg %
Protein bound iodine	12	
Newborn		*4 15 μg %*
Adult		4 8 μg %
Butanol extractable iodine	12	3 5 7 μg %
I^{131} uptake	—	*15-45% in 24 hr* 7 25% in 6 hr
Basal metabolic rate	—	±15%

* A nearly full centrifuge tube about 12 ml

3 Pregnanediol and Pregnantriol

Compounds are relatively stable and need not be collected in any special way

BIOASSAYS

1 Gonadotrophin Assay

The specimen bottle should be kept under refrigeration during collection

2 Pregnancy Test

The first morning urine specimen may be used for either the frog or the rabbit test. The assay measures chorionic gonadotrophin which is largely luteinizing hormone The patient should restrict fluids from midnight and avoid taking medication during that period The bioassay specimen should have a specific gravity of 1 020 or greater Blood serum may also be used for this purpose

ACTH TEST FOR ADRENAL FUNCTION

Because of the large diurnal fluctuations in blood corticoids it is important to start the test at a standardized time such as 8 30 A.M Twenty five ml of blood is drawn into a heparinized syringe and *immediately* sent to the laboratory in a special centrifuge tube Twenty five I U of ACTH is added to a volume of intravenous fluids which is calculated to run at a steady rate for the next 6 hours The last of this infusion should have run in exactly 6 hours after the test was started At this time a second heparinized blood sample is drawn exactly as the first and sent immediately to the laboratory

URINE ACTH TEST

A urine specimen for 17 hydroxycorticoids should be collected on the first day and again after several days stimulation with ACTH given either as the gel or by infusion. Zinc corticotrophin is also useful as a stimulating agent The second 24 hour specimen is collected to measure the rise in 17 hydroxycorticoids This test lacks the standardization of the blood response test and its interpretation is frequently difficult

diurnal variations in steroid excretion, it is important that this aliquot be obtained from a complete 24 hour specimen The patient should be afebrile and reasonably free from stress if meaningful results are to be obtained If liver or renal function is impaired the tests may be invalid

2 Technique of Collection

The precise time of starting the collection is specified and the patient s bladder is completely emptied by voiding *This urine is discarded* All subsequent urine passed in the next 24 hours must be collected including a final specimen obtained *exactly* 24 hours after the start of the collection

3 Precautions

A If a patient is sent to the X ray Department or a special clinic his bottle should accompany him and specific provisions should be made to prevent loss of urine

B The patient should be urged to empty his bladder before having a bowel movement If urine and feces are mixed they may in some instances be separated by filtration or decantation

C If a break in urine collection occurs the 24 hour collection should be started over again but in suspected cases of endocrine tumors the partial urine collection should be labeled with the time and sent to the laboratory

D All urine collections should be labeled on the bottle with the times and dates of starting and stopping

STEROID STUDIES ON 24 HOUR URINE SPECIMENS

1 17 Ketosteroids

The collection should be made in a container to which 5 ml of toluene has been added

2 17 Hydroxycorticoids

The specimen should be refrigerated throughout the collection and promptly dispatched to the laboratory

14 Specimens for Cytology and Pathology Laboratories

VAGINAL AND CERVICAL SMEARS

Glass slides with frosted ends and jars with fixative for the smears are supplied from the Pathology Laboratory

1 Before making the smears the name and unit number of the patient and the source of the specimen should be printed in lead pencil on the frosted end of each slide to be used for that patient The same side of the slide should be used subsequently for the smear
2 Material may be obtained by scraping aspiration or swabbing Use of the swab is not preferred Always obtain the specimen before using lubricating jelly Scraping may be carried out with a tongue blade or cervical surface biopsy scraper the specimen being obtained from the squamo columnar junction or localized lesion If aspiration is done the material is placed on the slide from the pipette and the side of the pipette above the tapered end may be used to smear the material If a swab is used the smear should be made by rolling the swab on the slide and not by rubbing the slide as this tends to dry the specimen and distort the cells
3 *Immediately* upon making the smears place the slides in the bottle of fixative *The smears must not be allowed to dry* Slides should be placed with the clean surfaces together so that smears do not face one another These precautions permit optimal preservation of cytologic detail in the smears
4 These bottles with the properly filled out *cytologic examination request sheets* are sent to the Pathology Laboratory

WATER EXCRETION TEST

The excretion of a water load is deficient in patients with adrenal cortical insufficiency This function may be conveniently examined as follows after fasting since the evening meal of the previous day, the patient is instructed to empty his bladder as completely as possible on the following morning The time of voiding is noted and the patient is asked to drink a volume of water equivalent to 20 ml per Kg of body weight over the next 45 minutes The volume of urine voided during the 5 hours since the beginning of the test is measured A normal response is the excretion of approximately 80% of the volume ingested This test represents a simple screening method for adrenal cortical insufficiency as a normal response virtually excludes the diagnosis However an abnormal response may be caused by other disorders and is therefore not specific

BUCCAL SMEARS FOR SEX DETERMINATION

Cytologic study for the sex chromatin may be conveniently done on buccal smears Slides should be scrupulously cleaned with acetone and ether The lower lip is cleansed with a dry sponge before tissue is obtained by gentle scraping

2 The Tissue Should Be Handled Gently

Grasping a sample of human flesh with forceps or other instruments may completely distort the structures beyond the point of recognition Cauterization should be avoided wherever practical heat coagulation may make interpretation impossible A knife biopsy is usually preferable

3 Fixation Should Be Carried Out Promptly

For small biopsy specimens jars of 10% formalin are provided The tissue should be promptly placed in formalin and the container fully labeled Wrapping the specimen in gauze wet or dry may interfere with fixation Flat tissues (e g skin) should be mounted on heavy absorbent paper to prevent curling during the shrinkage that occurs with fixation

4 Orienting Labels Are Always Helpful

Without obvious landmarks orientation of a detached specimen is impossible When tissue is submitted from different sites it is imperative that *the specimens be separated and identified*

5 Fill in the Indicated Information on a Surgical Pathology Request Form

The form as submitted becomes a part of the permanent record of the study Short cuts in submitting all of the requested information nearly always result in faulty interpretations or wasted time by all concerned with the biopsy Such facts as the patient s age sex, exposure to irradiation exact site of lesion etc often markedly influence intelligent histologic appraisal Carefully recorded gross observations of the lesion in situ are frequently of critical importance

6 Deliver the Specimen and Request Slip to the Pathology Laboratory or One of the Collecting Stations

Care regarding the foregoing steps is useless if this step is neglected

FLUIDS SPUTUM AND GASTRIC CONTENTS

1 Early morning urine and sputum should be collected in a clean container and sent to the laboratory immediately
2 Twenty four hour specimens are not desirable for examination because cytolysis occurs reducing the diagnostic value of the specimen
3 Pleural and ascitic fluids and gastric contents should be delivered to the laboratory as soon as possible after the specimen is obtained
4 If it is necessary to collect a specimen after 4 00 P M it may be preserved by adding to it an equal quantity of 10% formalin or absolute ethyl alcohol and placing it in an ice box until it can be delivered to the laboratory with a cytological examination request sheet

OBTAINING TISSUE FOR BIOPSY

Biopsy consists of 2 major steps
1 Obtaining tissue for study
2 Gross and microscopic evaluation of morphologic changes

Since these 2 steps are usually carried out independently by different individuals close coordination between them is mandatory Each member depends on the observations of the other in making an intelligent evaluation For expediency in handling large numbers of cases this is accomplished by written correspondence (request slips report forms) and by mutually arranged signal systems (orienting sutures labels etc) Most of the difficulties with biopsy procedures result from failure of accurate communication of ideas or information between the 2 groups of persons involved

In the proper technical performance of the first step the following are the most important points to be kept in mind

1 Tissue Obtained for Study Must Be Representative of the Lesion

Necrotic tissue fragments from superficial portions of lesions and specimens that do not include the actual lesion add little to the study It is desirable that the specimen include a portion of normal tissue as well so that anatomic relationships can be established

15 Circulation Time and Venous Pressure

CIRCULATION TIME

1 Principle

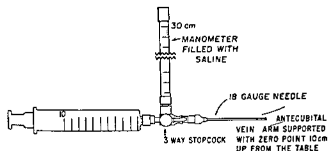
The circulation time is determined by injecting a foreign substance rapidly into a peripheral vein and noting the time elapsing between the injection and the arrival of the substance at some other point in the circulation The usual method measures the arm to tongue time and employs solutions of magnesium sulfate or Decholin (sodium de hydrocholate) Volatile substances such as ether are used for estimations of the arm to lung time

2 Method

The test is performed with the patient recumbent and relaxed He must be told not to hold his breath as this may retard venous return to the heart The nature of the end point should be explained to the patient as well as the necessity of his announcing it *immediately* by some agreed signal such as now After the tourniquet is applied and an 18 gauge needle inserted the tourniquet is released and 20 30 seconds allowed to elapse to permit re-establishment of normal circulation in the vein before the injection is made The latter must be made rapidly (in about 1 second) and the time to the end point measured precisely —with a stop watch if possible

7 **Except in Emergencies Allow 48 Hours** for processing of tissue preparation of slides and microscopic interpretation Urgent cases can be handled in 24 hours if requested but a rushed study is invariably inferior to a thorough one

readings are made until they are constant The normal range is 1 9 cm



3 Material

Some of the substances commonly used are

A MAGNESIUM SULFATE
Quantity 3 ml of a 20% solution
End point Hot sensation in tongue and pharnyx.
Normal arm to-tongue time 7 17 seconds

B DECHOLIN
Quantity 3 ml of a 20% solution
End point Bitter sensation and involuntary grimace
Normal arm to tongue time 10 16 seconds
Comment Sharp and usually reliable end point, but relatively expensive Occasional reaction

C ETHER
Quantity 5 minims of ether and 10 minims of normal saline (1 4 ml paraldehyde may be substituted)
End point Facial grimace cough ether taste or smell
Normal arm to lung time 4 8 seconds

VENOUS PRESSURE

The patient is supine and relaxed with the arm abducted to 60 to avoid compression of the axillary vein The arm should be supported on a pillow and towels so that the ante cubital vein is at a level 10 cm up from the skin of the back (This represents approximately the level of the opening of the venae cavae into the right atrium) The patient is in structed to relax and breathe naturally A tourniquet is applied to facilitate venipuncture The barrel of the syringe should be *moistened* with heparin to prevent clotting in the system The 18 gauge needle is inserted cleanly into a large antecubital vein so as to obtain a free flow of blood and the tourniquet is *removed* The saline filled manometer is attached in the man ner shown in the following diagram and the manometer is permitted to communicate with the vein via the *3 way stop cock* The height of the column of saline when it comes to rest in the tube represents the venous pressure Consecutive

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